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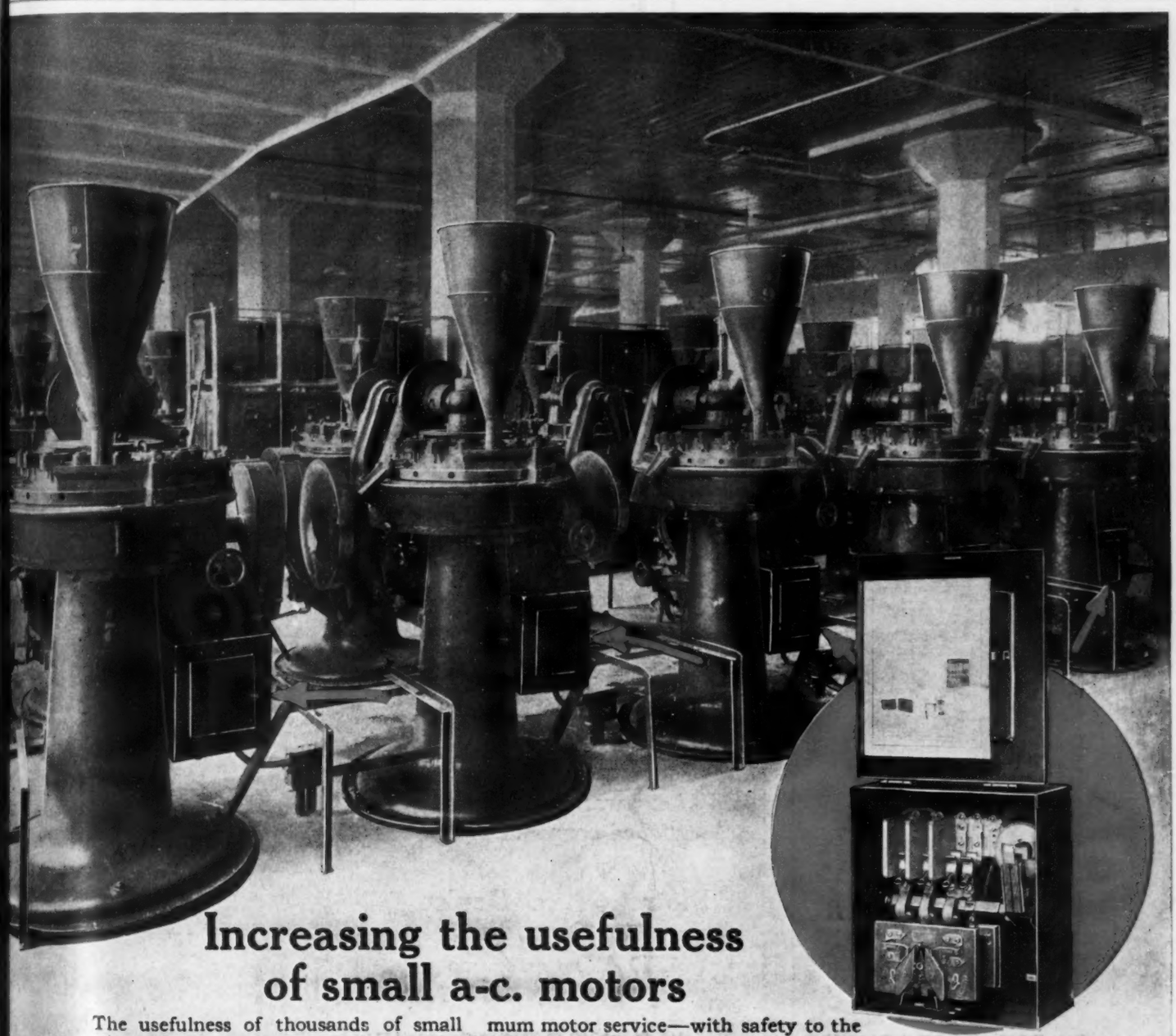

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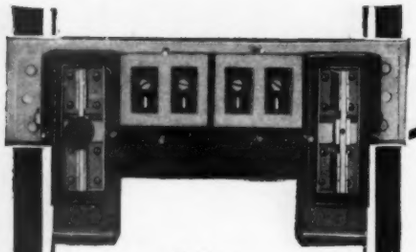

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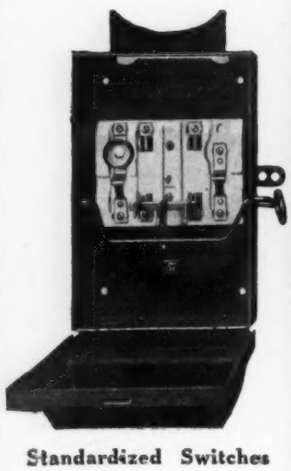

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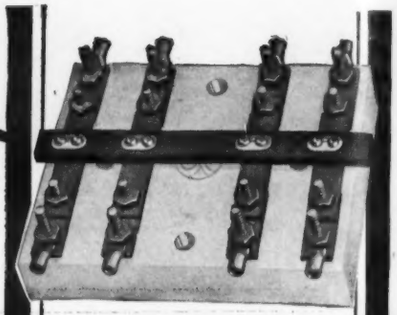

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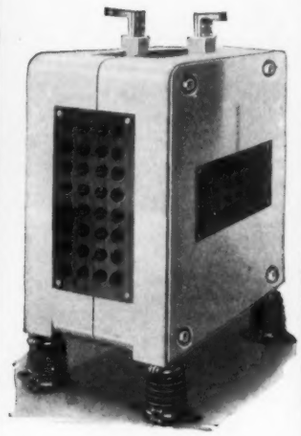
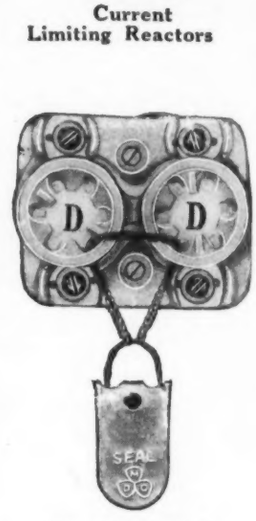


Current
Limiting Reactors



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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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Plans of the Lighting Educational Committee Take Definite Shape

THE more definite information which has just been given out as to the plans of the Lighting Educational Committee will meet with a ready response from the entire industry. A fund of half a million dollars subscribed principally by the manufacturers of lighting equipment—which, of course, includes lamps—is being raised and is said to be already assured. This money will be spent to promote a nation-wide essay contest among school children on the subject of home lighting. Winners of local contests will receive local prizes and then compete in a national contest. A competition among architects will produce designs for three houses, perfectly lighted and completely equipped electrically, which will be erected and presented as the high prizes to the winners of the essay contest. The whole program will be nationally advertised.

The plan is ingenious and appealing. The idea of an essay contest is sufficiently simple and clear-cut for people to grasp quickly. It will lead to careful study of the characteristics and value of good illumination and to the critical inspection and comparison of the lighting in many homes. It will cause a large number of architects to consider seriously the lighting problem of the small modern home, and this alone will be worth a great deal. Moreover, because the first three prizes are actual homes, the matter becomes of particular concern to the parents of competing children and will lead to their active participation. The many other prizes will offer ample hope and incentive to work. There should be widespread interest and a wide response on the part of the public.

Such a promotional activity on such a scale cannot help but produce results of great direct or indirect benefit to every branch of the electrical industry, and it should and will have the support of all classes. The N. E. L. A. has already taken formal action to promote the work. The lighting-fixture and glassware manufacturers, the contractor-dealers, the jobbers, the lamp manufacturers are all taking active part. The facilities of the Society for Electrical Development will be employed extensively, which is as it should be, for this neutral workshop has been set up for just such jobs.

The fact that this great promotion campaign comes just at a time when the industrial market is falling off and some other source of business must be strenuously sought should be a further appeal to manufacturer, jobber-contractor and dealer—and to the central station also. The American people today have money to spend, even though industrial buyers are for the time quiet and cautious, and the field of home lighting offers great possibilities. It is a fruitful endeavor for the public, who gain better lighting, and for the industry, which thus develops its business.

The Lighting Educational Committee has a great opportunity to render a very valuable service.

The President and Muscle Shoals

EVER since Henry Ford made his offer for Muscle Shoals the ELECTRICAL WORLD, which was the first to attack it and for months fought it alone, has maintained that the acceptance of the offer would be contrary to public policy because it contravenes the spirit and letter of the federal water-power act of 1920 and because it seeks public property for private use and individual gain. Having followed the vicissitudes of Muscle Shoals in Congress long before the Wilson administration determined on its development for war purposes, and knowing something of the propaganda carried on by the Ford interests since the Harding and Coolidge administrations decided to dispose of it, the ELECTRICAL WORLD has some comprehension of the value of Muscle Shoals as a source of hydro-electricity and of the length to which some lobbyists would go to get it in the clutches of their employers.

Recognizing as it does the strength and persistence of the Ford bill advocates, the ELECTRICAL WORLD none the less refuses to believe that the President of the United States ever came to an understanding with Ford himself or with any one else regarding the ultimate disposition of the government property at Muscle Shoals. While it might be in the heart of a man to ask such a favor, it is inconceivable that so reticent a person as President Coolidge would commit himself unsolicited on the issue. The accusation that he did so to an obscure and unknown newspaper man carries its own refutation. Congress and Congress alone will in due time decide what is to become of Muscle Shoals, and then the President may indorse or veto the bill. It seems unlikely, however, that any disposition will be made of the property by the present Congress, understanding or no understanding, and the attempt to calumniate the President will only serve to make postponement of action still more probable.

The New Brooklyn Station

ANOTHER station has been added to those already existing in the New York territory. Yet even the addition of the 400,000-kw. Hudson Avenue station to the Brooklyn Edison Company's system is but a temporary increment to the energy supply of the metropolitan district. For with all the advantages of interconnection available other big stations are already in prospect for adjacent systems, and the use of electricity continues to increase at a rate which absorbs new stations as fast as they can be built.

Striking features of the new station are numerous, but the keynote of the design is reliability of operation. Every precaution is used to insure safe operation of the unit groups of equipment, and it is interesting to note that vertical phase isolation was chosen. Satis-

factory foundations were difficult, and sufficient street area for cables to carry away the energy at low voltage in the congested district was not available. Thus a tall superstructure, large units, the use of auto-transformers and 27,000-volt cables were determined upon as the best economic solution to these problems.

The protection of the large generators, transformers and switches is particularly complete, and the layout of switching equipment is interesting because every effort was made to get an installation easily operated and maintained. Remotely controlled power mechanisms reduce labor to a minimum, centralize operating responsibilities and make it possible to get repairs made quickly and easily. The designers have also given a great deal of attention to the illumination and communication features of the station.

The Brooklyn Edison Company is to be congratulated on the new station, and its many new features of design will be the subject of a great deal of interest from an operating standpoint. Questions may be raised regarding the location of the control room on the top floor and also the location of the heavy switch mechanisms in the upper floor as it would seem that building costs and control wiring could have been reduced by placing these at a lower level. Also the unusual and elaborate switching and wiring layout for cable and meter testing may be considered an unnecessary expense and even an operating hazard by those accustomed to use simple jumper connections where testing is required. But designers' opinions always differ on many features in any specific plant. The new station as a whole marks a real advance in the art, and its operation will be closely studied by all engineers interested in station practice.

The Central Station's Responsibility as Shown by the Appliance Survey

THE central station is by the nature of its position in the local electrical family compelled to accept responsibility for maintaining a merchandising standard in the community in the sale of electrical appliances. If there was any doubt of this in any one's mind, it is certainly answered in the findings of the ELECTRICAL WORLD'S recent investigation as to who is selling electric appliances. The companies in all of the eleven cities investigated are, in one way or another, wielding a strong influence upon the retail sales policies of the dealers in their respective cities. Whether this direction on the part of the local company is by means of actual merchandising or whether it is through an active interest in the local electrical league, the fact remains that no central-station manager is willing or can afford to allow the appliance business to drift aimlessly where it will.

Those companies which retired from merchandising or from any active interest in it, thinking thus to leave the field entirely clear to the electrical contractor-dealer, found that the experiment did not work. As a merchandiser the contractor was not a success, for he could not divide his attention between merchandising and contracting and make a profit from both. The non-electrical dealer, who for a number of years had sold appliances in a desultory manner, stepped in at this point and rendered the service which the public was demanding. The fact, however, that hardware, furniture and department stores are actively engaged in the sale of electrical appliances should not be taken as an indication that they will smother all other competition. Perhaps the greatest single indication of the permanence of the electrical appliance business is the extent to which such staid merchants as the hardware, furniture and department store men have accepted this business.

Above all else there remains the question of service and public relations. Central-station companies themselves cannot afford to sell sub-standard appliances to their customers and by active merchandising can do much toward raising the general standards in a city. When customers feel that they are getting value received from their devices not only in the appliance itself but in the service it gives, there is no question that they place a higher value on the entire service rendered by the central-station company. Thus it appears that if the central-station companies would have their customers enjoy the maximum benefits from electric service, they must take an active part in the sale of energy-consuming devices.

The Steam-Electric Station Impregnable as Basic Central-Station Factor

THERE has been wide variation in the many figures issued from time to time on the water power available for development in the United States. These have ranged from conservative underestimates based on minimum flow, available 100 per cent of the time and at sites easy to develop, to extreme exaggerations such as the Chicago *Tribune's* notable plan to harness every drop of rainfall on the North American Continent. It is no wonder that the public, and to a certain extent the electrical industry itself, should be hazy on this subject, and it is therefore a welcome and valuable contribution that the Geological Survey makes in the study that it has just completed of the water power "available 90 per cent of the time," and which it therefore terms practicable — from an engineering standpoint — to develop.

A study of the correlation of these figures to the plans and requirements of the central-station companies, based on the ELECTRICAL WORLD'S survey of January 5, 1924, is enlightening (see pages 916-917 of this issue). Any notion that water-power development—desirable and necessary as it is—will render steam-electric stations obsolete and unnecessary will be immediately dispelled. Great as the water powers of this country are, their energy can supply only a part of the total electrical energy which this nation needs and demands. And much of what is available from an engineering standpoint is not yet available from an economic or political standpoint. On the one hand, the large amount available in the Mountain and Pacific States is still too far from the Eastern industrial market—and it will surprise some to realize from a study of the largest, or national, diagram that even were it possible to deliver all the water power to points where it can best be utilized, the energy requirements of the country would still not be met. On the other hand, large developments, such as those projected on the St. Lawrence and the Colorado, will not be realized until political controversies and treaty provisions, some international in character, have been settled.

More accurate, or at least more comprehensive, conclusions could, of course, be reached on a kilowatt-hour basis, allowing for maximum utilization of varying steam flow if adequate statistics were obtainable. The

proper combination of steam and hydro operation can be worked out only on that basis and with full consideration of load curves. But in the central-station business what must be provided in generator capacity is ability to handle peak loads, and this must always be kept in mind as well as average load.

No matter how the subject is approached, the conclusion must still obtain that the steam-electric station will continue to be the basic element in the supply of electrical energy, and that the proper development of water power is in conjunction with the steam plants, in order to gain maximum efficiency, maximum economy and maximum dependability of service.

Capitalize Experience with Outdoor Structures

THE design of outdoor substations has become increasingly important because of the more extensive use of high-tension lines and a consequent increase in number and in cost of substations for serving towns and industrial customers. The investment in structures and auxiliary devices is so large compared with the cost of transformers that each new load becomes a serious economic problem. It is desirable to have flexibility and provisions for future changes or enlargements, and a very important element is the selection of devices to provide adequate protection to the high-tension line from troubles arising in the substation or transformers. After good engineering has been applied to the general layout all these elements in the design reduce to a problem in economics.

A study of a number of substations on several operating properties shows wide differences in both opinions and practices. For example, reinforced concrete, latticed steel, structural steel, wood, pipe and patent structures are used by different properties, and each considers its practice the best from an economic and service standpoint. Then, again, there are hand-operated, motor-operated, solenoid-operated and gang-operated disconnecting switches, automatic and non-automatic air-break switches, high-tension and low-tension switches, fuses, relays, arresters and meters to use or not to use. And in addition each engineering staff exercises its own ingenuity in layouts to secure flexibility, strength, a minimum number of insulators and a low installation and maintenance cost.

This situation is but a natural result of system growth, of varying service requirements and of individual operating experiences. It is, in fact, questionable whether any great amount of standardization should be practiced when economic, operating and service requirements are so different on the various properties. In some territories with light loads and extensive high-tension lines it is imperative to use cheap structures even though service suffers. In other sections service is paramount and heavy investments can be carried because the load density is great and rates are adequate. There are also trunk-line circuits which cannot be tapped without protecting them from every imaginable trouble that might be predicted because of the tap substation.

But experiences should be available and costs recorded in sufficient quantity to permit of a greater uniformity in opinion and practice, at least under similar conditions. The fields of application of the different materials used in substation structures should be more definitely stated and certain general design principles agreed upon. This work is sufficiently important to receive consideration by the proper committee of the National Electric Light Association.

Noteworthy Public Service by New England Engineers

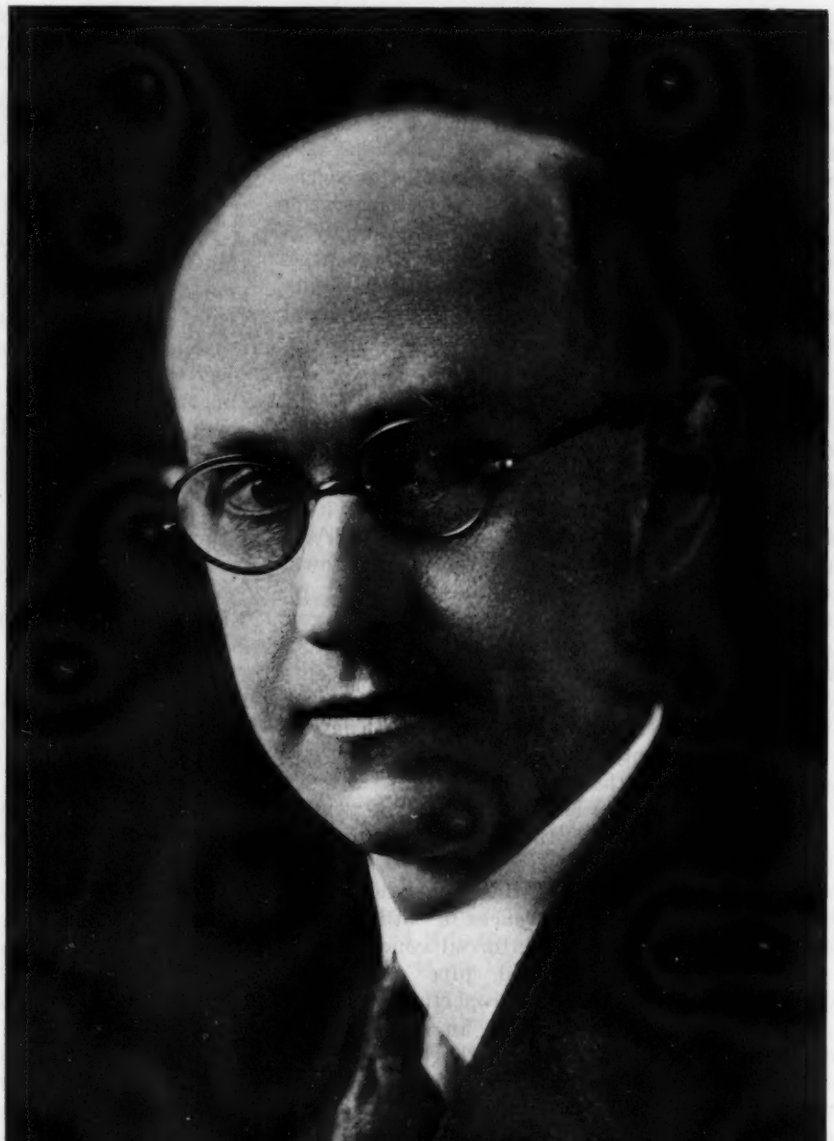
BY CONTRIBUTING specialized knowledge, seasoned judgment and voluntary toil to a year's investigation of the power resources of New England as embodied in the report abstracted elsewhere in this issue, a distinguished group of Boston engineers and associates has performed an important and significant piece of work. The Associated Industries of Massachusetts, under whose auspices the investigation was conducted, is to be congratulated upon the thoroughness of the inquiry and the completeness of its published material. Having as manufacturers a very vital interest in an abundant supply of power, they showed commendable enterprise and excellent business judgment in fostering such a survey.

To those who believe in the industrial future of New England and in the increasingly vital part the central station is playing in its destinies the document gives encouragement. The area of these six states is small in proportion to the whole country, but their industrial development in the central and southern sections is enormous and diversified, growing steadily and developing electrical needs which can only be met by a far-sighted and constructive program embracing the full economic co-ordination and construction of hydro-electric and fuel-burning resources. Central-station energy, distributed by large interconnected systems, is the logical source of supply for three-fourths of the growing industrial load of the Northeast, and this conclusion of the committee is accompanied by the declaration that the cost of this power can be kept from increasing only by the early importation of water power capable of relieving the fuel-burning stations of a large share of the base load. No engineer would have expected the signers of this report to be swept off their feet by popular ideas of water-power cheapness, and in so clearly setting forth the best available cost information upon present industrial and utility plant production and overheads and upon water-power economics the committee has prepared and effectively discussed some extremely valuable data.

Interconnection must be the cornerstone of the future New England power structure, and the achievements already accomplished along this line receive ample credit in the report. This means that in due course hydro-electric power from the St. Lawrence and tributary valleys will have to be seriously considered. The potential hydro-electric resources of New England are still substantial, but Maine's singularly short-sighted non-exportation law blocks development in one direction, and the anticipated growth of demand already indicates that an economic market in lower New England for Canadian power and an internationally beneficial agreement are attainable. Fuel-burning plants on tidewater will comprise the foundation of future power development in New England, but as these are linked more and more effectively with each other and with hydro-electric developments planned, constructed and operated with maximum engineering efficiency and financial acumen, the whole region will be the gainer and its growing power needs will be satisfied on the basis of a sound and enduring policy.

Markham Cheever

A central-station engineer prominent in the field of hydraulic power.



THE great capacity for work, the thoroughness and the aggressiveness of Markham Cheever, general superintendent and chief engineer of the Utah Power & Light Company, are reflected in the remarkable progress which that company has made since its organization with Mr. Cheever in charge of operation and construction. He has a remarkable faculty for grasping and analyzing a situation or problem and of predicting the results. His executive ability and his kindness and consideration for his subordinates have all made for harmony and efficiency in his organization.

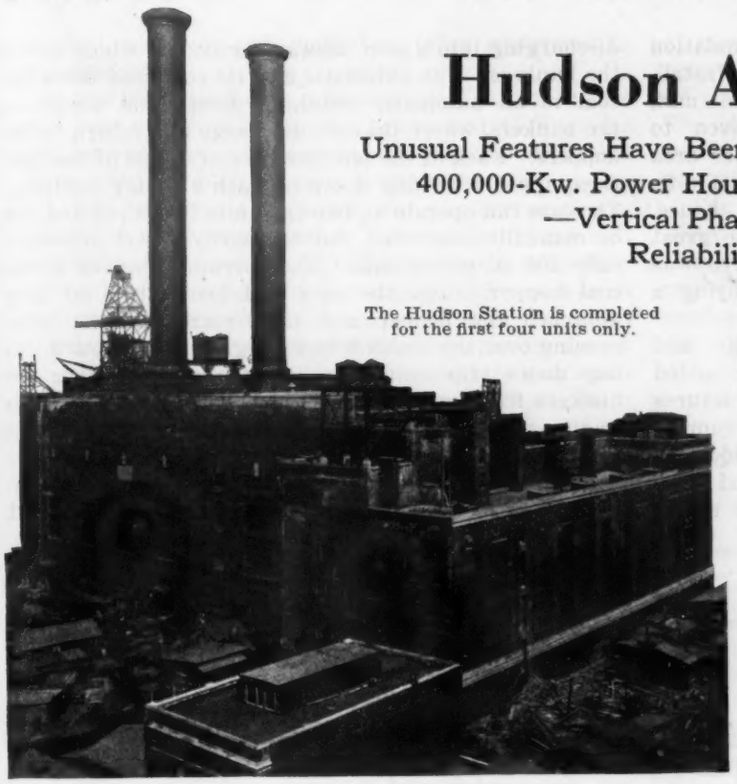
Mr. Cheever was born at Ann Arbor, Mich., in 1880. He was graduated in electrical engineering from the University of Michigan in the class of 1903. Immediately after leaving college he took up the duties of assistant engineer during the construction of the first section of the Ontario Power Company's development at Niagara Falls and served in that capacity for three years. He then moved to the West, where ever since he has been associated with pioneer development work in the Intermountain region.

During the latter part of 1906 he became engineer in charge of the construction of a 5,000-hp. high-head hydro-electric plant at Ames, Col. From 1908 to 1912 inclusive, as assistant chief engineer of the Telluride Power Company, he was engaged in hydro-electric developments in Utah, Idaho and Colorado. He was first sent to Grace, Idaho, to take charge of the initial development of Bear River at that point. After two years of such work he went to Provo, Utah, as assistant chief engineer for the company. When the reorganization of the power industry in Utah came about in 1912, which resulted in the formation of the Utah Power & Light Company out of sixteen smaller companies, Cheever was the man most familiar with the problems of the district, and he was made chief engineer, having charge of all construction work in addition to other duties. In 1918 he was also appointed general superintendent of the company, in charge of all physical property, construction, operation and maintenance.

Mr. Cheever has taken an active part in the affairs of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the National Electric Light Association. He was the first chairman of the hydraulic power committee of the N. E. L. A. in 1920 and served two years in organizing the work of this important committee.

Hudson Avenue Station

Unusual Features Have Been Incorporated in the Design of the New 400,000-Kw. Power House of the Brooklyn Edison Company —Vertical Phase Isolation Used—Service Reliability Governing Factor



The Hudson Station is completed for the first four units only.

THE Brooklyn Edison Company furnishes electric service to a population of two million in an area of 81 square miles, comprising the Borough of Brooklyn, one of the five boroughs making up Greater New York. Included in the total load are the famous Coney Island and a large number of manufacturing plants established along a waterfront of 200 miles. There are emergency ties with the Brooklyn-Manhattan Traction Company and with the New York Edison Company, and during the past year there has been provision for drawing up to 50,000 kva. from the United Electric Light & Power Company across the river. The rapidly increasing demand occasioned by the normal growth of population and industry and by the increasing use of electricity has required that the company add to its present total generating capacity of 190,000 kw. by the erection of a new station with an ultimate capacity of 400,000 kw., consisting of eight units of 50,000 kw., the first of which went into operation May 1. The second is being erected, the third is being manufactured, and plans are made for a virtually continuous program until the whole station is completed.

Electrical construction work has been greatly facilitated by the selection of equipment requiring a minimum of installation labor. The design of the 27,000-volt switching has been particularly successful in this respect, and the use of truck-type and dead-front switching on the low-tension supply has also worked out very well.

Transmission System in Cable at 27,000 Volts

The problem of transmitting from the Hudson Avenue generating station the enormous ultimate output of this station required a careful analysis in order to determine the proper transmission voltage. When plans for this station were begun the transmission voltage of the company was 13,800 volts. Studies were made to determine whether this voltage should be used from the new Hudson Avenue station or whether a higher voltage should be used. As a result of these studies it was found desirable to use 27,600 volts (double 13,800 volts) as the transmission voltage from Hudson Avenue station. The reasons for finding this voltage the most desirable are as follows:

1. The average distance of transmission from Hudson Avenue to the various substations (substations of 30,000 kva. operating capacity) is approximately 5 miles, and 27,600 volts was found to be more economical than 13,800 volts for an average transmission distance to substations greater than 3 miles.

2. The location of the generating station is such that there were only two streets available in which duct lines could be built for transmission cables without the purchase of private property, and these two streets were greatly congested with existing sub-surface structures. In order to obtain sufficient sub-surface space if cables at 13,800 volts were used, it would have been necessary to buy a large amount of private property. By using 27,600 volts it was found possible by a purchase of four city lots to make provision for the use of a third city street for duct lines. By building two duct lines, one on each side of these three streets, sufficient duct space was obtained for the ultimate output of the station. It is contemplated at the present time to build five duct lines with provision for the sixth line. Each of these duct lines will have duct space for twelve 10,000-kva., 27,600-volt transmission feeders, thus giving a capacity of 120,000 kva. per duct line. Another factor in determining the use of 27,600 volts instead of a lower voltage was that temperature surveys indicated that unless a large amount of private property was purchased on which duct lines could be built, the capacity of cables operating at 13,800 volts would be seriously limited by heating conditions. Temperature surveys indicated that there would be no difficulty due to heating if the amount of current to be transmitted from this station could be limited to that required at 27,600 volts.

3. With generation at about the highest practicable potential, namely, 13,800 volts, transmission at 27,600 volts permits the use of two-to-one auto-transformers, which are desirable from several standpoints.

4. It was found by careful test that a considerable amount of 22,000-volt cable already installed could be operated at 27,600 volts by making up new petroleum-filled splices with reservoirs. It was felt that a higher voltage than this would require new cable in all cases.

The new station is erected on the waterfront, and difficulties were encountered in insuring an adequate but inexpensive foundation and clean water for condensers. In addition the existence of a street in the restricted area available made it necessary to connect the main station with the switch house by means of a bridge.

After a series of tests and studies a mat foundation was found most economical and satisfactory to install. The general design called for a reinforced-concrete mat, 7 ft. to 10 ft. thick, placed on piles driven to refusal on 2½-ft. to 3-ft. centers over the entire area used by the main buildings and tunnels, while a 6-ft. mat without piles was used for the switch house. The presence of sand and water necessitated so great an expense for foundations that the station area was restricted to obtain an economic balance by using a comparatively tall superstructure.

A wharf was constructed in front of the site, and the boiler house was built next to the river as an added safeguard against settling of the heavier structures in the turbine room. The circulating-water tunnels were built by the use of cofferdams, and considerable ingenuity was required to develop economical and practicable construction methods under the difficult conditions encountered. Excavation was carried on by steam shovels and then steel-sheet piling was driven, after this a clamshell bucket was used, and timber bracing was installed in tiers as the excavation for the plant progressed.

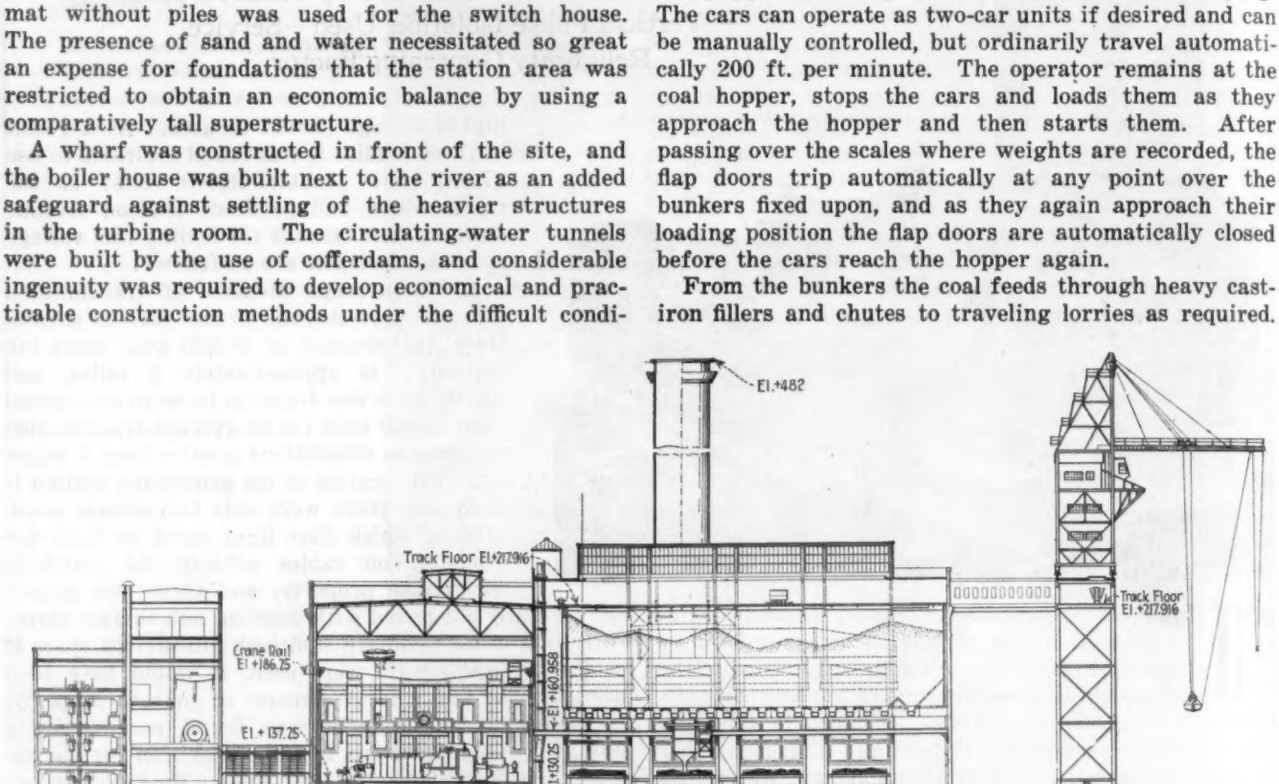
The circulating water requirements for the first group of two units is supplied through four intake chambers, each 10 ft. wide and 33 ft. deep, and four automatic self-cleaning traveling screens are used to remove débris, each having a rated capacity of 50,000 gal. per minute.

Coal-Handling Facilities

Land was not available for coal storage so that large bunkers are used in the station. The coal is delivered by barges at the dock, and these are unloaded by two traveling coal-handling towers equipped with 50-ft. booms and grab buckets. Each of the towers has a capacity of 250 tons to 300 tons per hour, and they discharge into a receiving hopper on the tower and thence go through a chute to a duplex single-roll crusher unit equipped with a bypass for handling the "fines."

The coal is then all delivered into a storage hopper provided with electrically operated duplex gates for discharging into a loop railway car system which serves the bunkers. The automatic electric coal road takes the coal to an automatic weighing device and thence to the bunkers, where the cars discharge and return to the hoppers. Each of the ten cars carries 5 tons of coal and is equipped with flap doors on each side for dumping. The cars can operate as two-car units if desired and can be manually controlled, but ordinarily travel automatically 200 ft. per minute. The operator remains at the coal hopper, stops the cars and loads them as they approach the hopper and then starts them. After passing over the scales where weights are recorded, the flap doors trip automatically at any point over the bunkers fixed upon, and as they again approach their loading position the flap doors are automatically closed before the cars reach the hopper again.

From the bunkers the coal feeds through heavy cast-iron fillers and chutes to traveling lorries as required.



ELEVATION OF THE HUDSON AVENUE STATION

Four boilers at the ends of the boiler room are supplied from a single-spout lorry and the remainder of the station uses a double-spout lorry to feed eight boilers arranged in rows of four and facing a common firing aisle. A hand-operated auxiliary or reserve lorry is provided in each aisle to insure continuity of operation.

A three-unit motor-generator set provides direct current for the hoist and trolley motors on the coal tower. The hoist motor is rated at 625 hp., 275 volts, 180 r.p.m., and the trolley motor at 75 hp., 250 volts, 485 r.p.m. For the 60-hp. propeller motor and other auxiliary motors 440-volt, three-phase induction motors are used, while each coal car is equipped with a 5-hp., 220-volt, single-phase, constant-speed motor.

Heat-Balance Arrangements

Since the station serves a metropolitan area, reliability was a primary consideration in its design, and every feature of the installation was based on using both a primary and secondary line of defense against service interruptions. In studying heat-balance arrangements a unit station group was considered as consisting of two turbo-generators, a house turbine and eight boilers with the necessary auxiliaries, and each group

was designed to be independent of other equipment in its operation.

As a primary method it was considered best to utilize main unit bleeding from two points and to heat the feed water to as high a point as possible with bled steam. But, in addition, as a house turbine was necessary to a reserve energy supply for auxiliaries, it was considered most economical to operate the house unit condensing in connection with the feed-water system.

Thus the condensate from the main unit condensers is pumped by the hot-well pumps through the intercooler and after-condenser of the air ejectors to a common header, and thence through the surface condenser on the house turbine to the boiler-feed pumps. It is then divided into parallel paths and goes through the parallel high-pressure and low-pressure closed heaters using the bled steam to the boilers.

The condensate from the closed heaters, the surface heater and the eductor condenser on the high-pressure gland seal of the General Electric turbine is pumped into the boiler-feed line.

One high-pressure and one low-pressure heater are used for each turbine and the General Electric turbine is bled at the tenth and sixteenth stages, while the Westinghouse unit is bled at the main connecting the high-pressure and low-pressure cylinders. At three-quarters load on the turbines these bled points correspond approximately to 55 lb. and 10 lb. absolute pressure, and each turbine will heat about 500,000 lb. of boiler-feed water per hour from 113 deg. F. to 325 deg. F. Each heater contains 3,500 sq.ft. of heating surface and is of especially heavy construction.

Boilers and Stokers

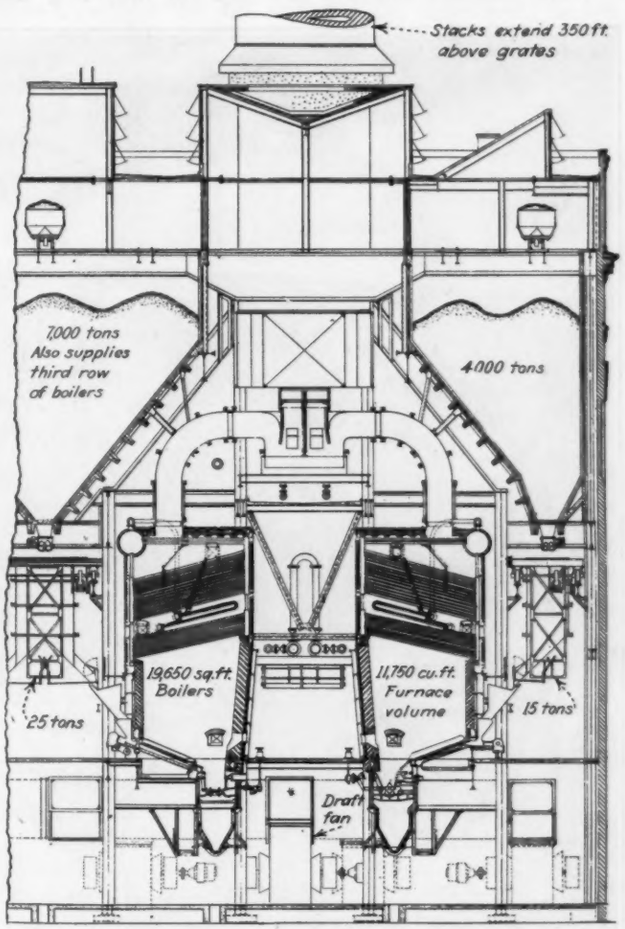
Eight boilers are installed for the first group, each having 19,650 sq.ft. of heating surface, 2,508 sq.ft. of superheater surface and a combustion volume of about 7,500 cu.ft. The boilers are forty-two sections wide and twenty high in double-deck construction, with the superheater installed above the first deck of six tubes. They are fired with underfeed stokers and the settings have a height of 21 ft. 10 in. from the floor line to the bottom of the uptake header. The inside width of masonry at stoker level is about 24 ft. 8 in.

The superheater is a single-loop type using 2-in. tubes and will give about 180 deg. superheat at 100 per cent rating and 200 deg. at 200 per cent rating with a pressure of 290 lb. to 295 lb. in the drum.

Six of the boilers use fourteen-retort Westinghouse new model, extra-long multiple-retort underfeed stokers equipped with vertical-wall clinker grinders. The coal used has a heating value as fired of 13,500 B.t.u. with a proximate analysis as follows: Fixed carbon, 74 per cent; volatile, 16 per cent; ash, 8 per cent; moisture, 2 per cent; sulphur, 2 per cent. These stokers are rated to burn 13 tons per hour, which is sufficient to develop more than 7,800 b.-hp., and are driven by Ward Leonard controlled motors having a speed range of 0-1,200 r.p.m. Each clinker grinder is divided in half, and each half is driven by a 300-1,200-r.p.m. direct-current motor.

The other two boilers of the initial installation are equipped with Frederick multiple-retort stokers made by the Combustion Engineering Corporation, and four similar units have been purchased for boilers in the second group installation. These stokers are fourteen retorts wide and thirty-one tuyères long and are interesting in having secondary rams consisting of a series of tuyères which form an active grate surface in the retort. The clinker grinder pit is in two sections, each of which is equipped with forced-draft air chambers. The stokers are capable of operating the boilers at 350 per cent rating continuously and burn about 24,500 lb. of coal per hour per stoker at continuous rating.

The ash is disposed of by water sluicing in brick-lined cast-iron sluiceways running under each row of four boilers and is discharged into a pit having a capacity of 4,670 cu.yd. From the pit a traveling crane equipped with a 5-cu.yd. bucket takes the ash to scows. Five motors are on the crane, and the usual cycle of



CROSS-SECTION OF BOILER ROOM

operation, consisting of closing the bucket, hoisting 36 ft., rotating 180 deg., dumping, rotating back 180 deg. and lowering 36 ft., can be performed in about sixty seconds.

Fans and Feed Pumps

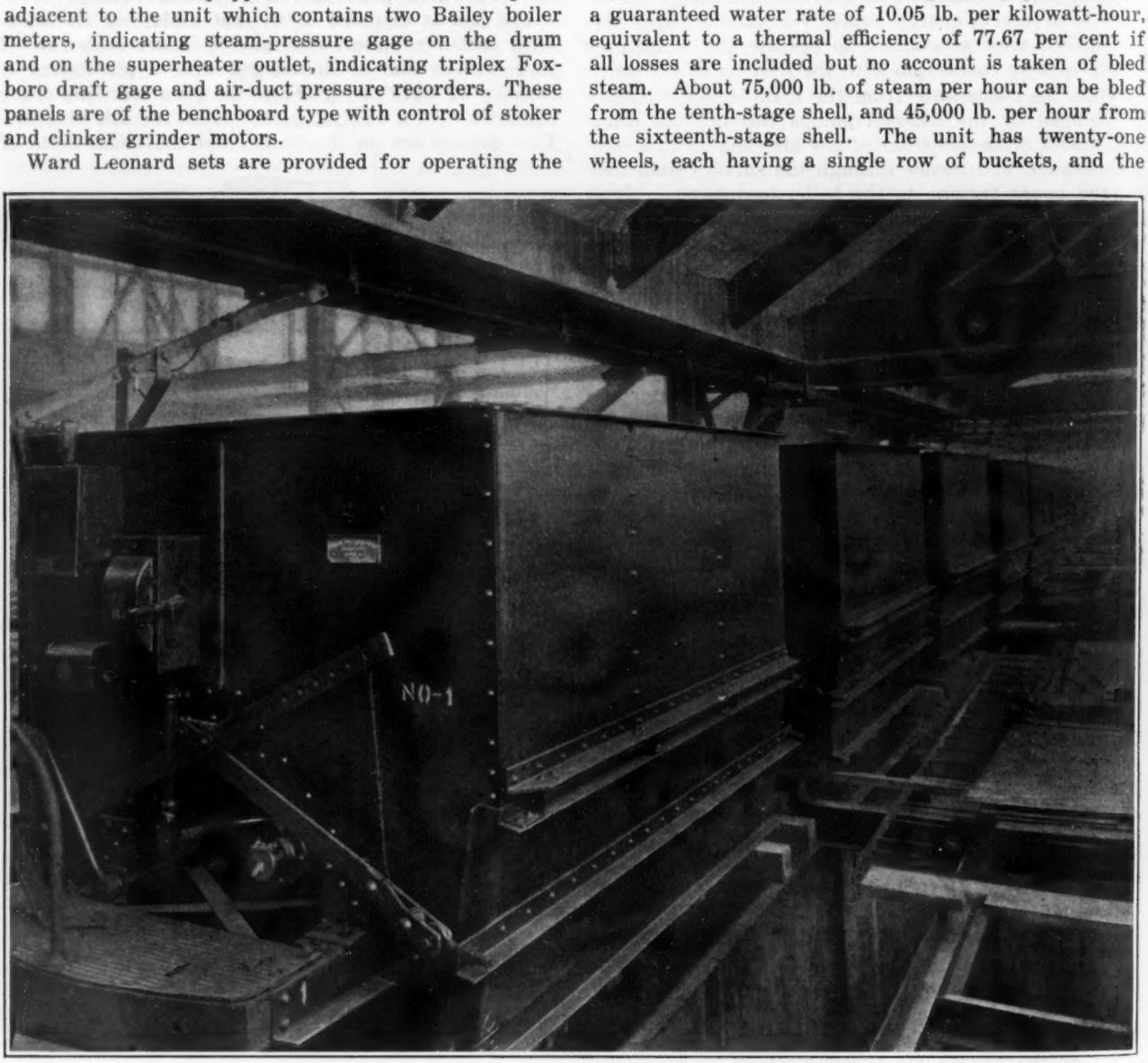
Four fans supply forced draft to the furnaces. The fans have backward-curved vanes which give a horsepower-limiting feature and are also designed to prevent great pressure changes with changes in air volume. About 170,000 cu.ft. of air with a 7-in. pressure can be obtained from the fans at 667 r.p.m. when using about 300 hp.

Three 1,500-g.p.m. centrifugal boiler-feed pumps are used on the first installation, each designed to handle 210 deg. F. water against a discharge pressure of 400 lb. per square inch, with a positive head on the suction side of 12 ft. and a full load speed of 1,750 r.p.m. The pumps are four-stage suction-impeller design with 8-in. discharge and 10-in. suction connections. Two of the

pumps are driven by 625-hp., 1,800-r.p.m. slip-ring motors operating at 2,300 volts, three-phase. The other pump is connected to a Terry turbine of 565 hp. rating designed for 1,750 r.p.m., 263 lb. pressure and 200 deg. superheat.

Each boiler is equipped with an instrument panel adjacent to the unit which contains two Bailey boiler meters, indicating steam-pressure gage on the drum and on the superheater outlet, indicating triplex Foxboro draft gage and air-duct pressure recorders. These panels are of the benchboard type with control of stoker and clinker grinder motors.

Ward Leonard sets are provided for operating the



AN ELECTRIC COAL ROAD CARRIES COAL TO THE BUNKERS

The cars are automatically operated, although provision is made for manual control. Two-car multiple-unit operation can also be used.

fans and stokers and eventually will be used in connection with automatic operation of the boilers by a combustion control system. With this in view the boiler room is laid out and equipped for operation at each station or as a unit from a central control room. For each group of eight boilers a panel is installed in the central control room, and in addition a master control panel will be available for operating all units in parallel.

LARGEST TURBINES IN THE WORLD

In order to conserve station cost and reduce the number of operating units to a reasonable value for a 400,000-kw. station, the designers selected for the initial installation the largest available steam turbo-generators, each having a rating of 62,500 kva. One is a General Electric single-cylinder machine and the other a tandem-compound Westinghouse unit. The General Electric unit runs at 1,200 r.p.m. and is designed for 265 lb. gage pressure at the throttle, 200 deg. F. superheat and 1 in. absolute back pressure. At 40,000 kw., its most economical operating point, it has a guaranteed water rate of 10.05 lb. per kilowatt-hour, equivalent to a thermal efficiency of 77.67 per cent if all losses are included but no account is taken of bled steam. About 75,000 lb. of steam per hour can be bled from the tenth-stage shell, and 45,000 lb. per hour from the sixteenth-stage shell. The unit has twenty-one wheels, each having a single row of buckets, and the diameter of the twenty-first wheel to the center line of the bucket is 11 ft.

In the Westinghouse unit the high-pressure and low-pressure cylinders are supported on a common bed plate with the generator. The high-pressure unit has a steel casing with a single-flow design, while the low-pressure cylinder is made of cast iron with semi-double-flow design having two exhaust nozzles. At 36,000 kw. load the absolute pressure of the steam at the high-pressure cylinder outlet is 51 lb. and the guaranteed water rate is 10.10 lb. per kilowatt-hour.

The generators are steam-driven 50,000-kw., 80 per cent power-factor, 13,800-volt, star-connected, with grounded neutral. Cooling air is recirculated and cooled by means of radiators. Each generator is connected without interposition of switching to three

single-phase 13,800/27,600-volt auto-transformers, which are installed in individual bays on the ground floor of the switch house and are oil-insulated and self-cooled.

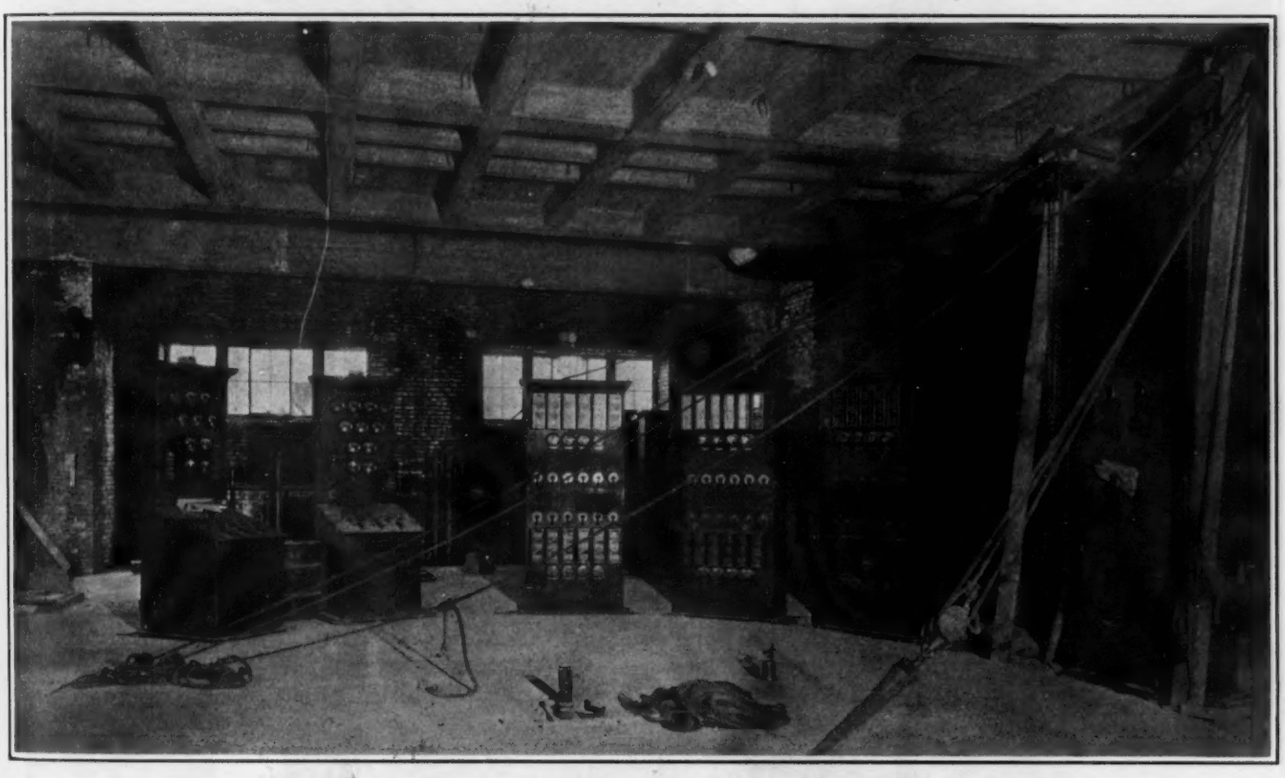
Generator leads from the generator to the auto-transformer and from the auto-transformer to the oil circuit breakers consist of single-conductor, 2,000,000-circ.mil concentric stranded cable with a 1-in. rope-core center. The conductor is insulated with $\frac{1}{3}\frac{5}{2}$-in. varnished cambric, covered with a $\frac{3}{4}$-in. lead sheath. The lead sheath is further insulated against circulating currents by means of a special outer covering consisting of two layers of 8-oz. duck tapes applied with a lap and thoroughly filled with an asphalt compound. The lead sheaths are connected together and grounded at one end only of the cable.

Each generator with its corresponding auto-transformer is protected as a unit by an over-all differential relay system in combination with a split-conductor system made possible by bringing out both ends of each generator winding. This arrangement gives complete protection, including the intermediate leads, against overloads, grounds or short circuits.

27,000-Volt Buses

Each unit of generator and auto-transformer will normally be connected to an isolated section of the main bus, supplying eight 10,000-kva. feeders with 3 per cent reactors. Each bus section will normally be connected to a synchronizing bus through a 10 per cent reactor and can be switched on either one of two adjacent generating units, without ever tying the two units together except through the synchronizing bus and two 10 per cent reactors. This arrangement has effected a notable saving in breaker capacity due to reduction in short-circuit currents. The synchronizing bus is cut into sections and protected by a series of overlapping differential-relay schemes which include the breakers.

All 27,000-volt bus work consists, except for the synchronizing bus, of copper rods or tubes of relatively short lengths which are in effect jumpers between switches and reactors. These jumpers consist of both copper rod having a circular cross section $1\frac{1}{2}$ in. in diameter and round copper tubing having an outside diameter of $1\frac{1}{8}$ in. and an inside diameter of $\frac{17}{32}$ in. Both the rod and tube jumpers are covered with a baked compound having a dielectric strength sufficient to withstand successfully an applied potential test of 58,000 volts, 60 cycles, for five minutes. These jumpers are between the switches and reactors on each phase floor directly under the ceiling. The synchronizing bus is composed of two 2,000,000-circ.mil single-conductor cables in parallel, run in ducts in the fill of the ceiling or floor above. The same type of cable is used as for the generator leads.



VIEW IN THE HIGH-TENSION CONTROL ROOM ON THE TOP FLOOR WHILE UNDER CONSTRUCTION

The potential leads consist of single conductor No. 14 A. W. G. "Nichrome" wire covered with an approved heat-resisting material. The conductor is then wound over a $\frac{3}{4}$-in. lap core in close spiral. The conductor resistance is equal to 4.6 ohms per foot of cable measused on the completed cable. This conductor is then insulated with $\frac{1}{3}\frac{5}{2}$-in. varnished-cambric insulation, covered with $\frac{3}{4}$-in. lead sheath.

Vertical Phase Isolation

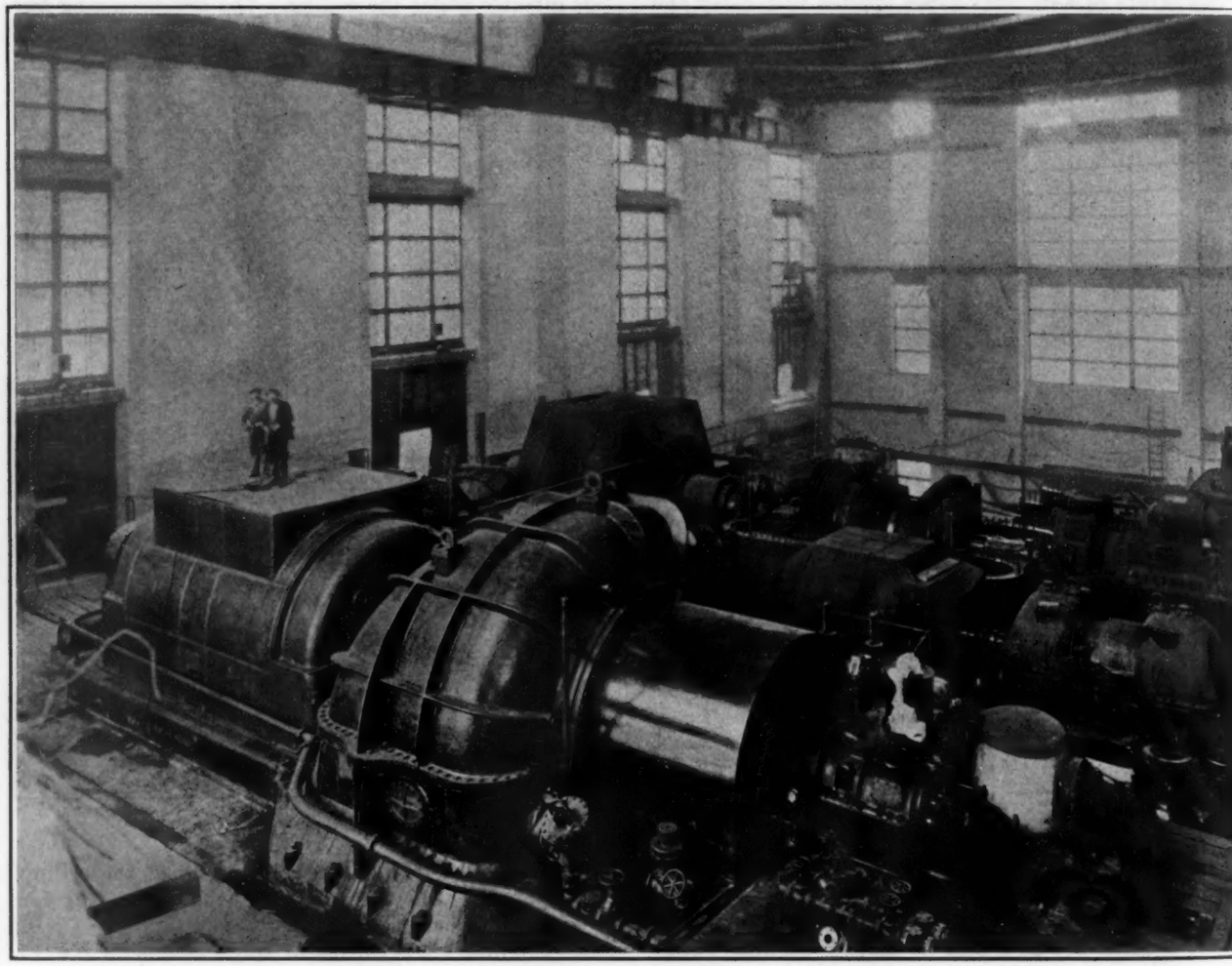
The 28,000-volt oil circuit breaker switching equipment is of the vertical isolated-phase type having mounted on each floor one pole of the oil circuit breaker and on the fifth floor the operating mechanism for operating all three poles. This switch has been designed so that all operations for inspection, disconnecting or removing and changing tanks are done electrically. All auxiliary equipment, disconnecting switches, current transformers, etc., are contained in the switch itself, thereby eliminating all compartment construction.

The oil circuit breaker is normally controlled from the main control room on the seventh floor. There is another control station on the mechanism floor with a throw-over switch so that the control can be removed from the control room and transferred to the mechanism floor for test purposes. The breaker can be controlled from only one control station at a time. On the mechanism of the oil circuit breaker are mounted a motor and gear for raising, lowering and disconnecting. A clamping device is also provided. When it is properly clamped in place the oil-circuit-breaker tripping and closing solenoids can be operated, and when it is released the tripping and closing solenoids become inoperative and the raising and lowering motor operative. This motor has two separate and distinct operations in lowering and is controlled by three separate control buttons. Step No. 1 is to lower the oil circuit breaker to the "disconnect" position. Step No. 2 is to lower the oil tank for inspection. The process of raising is similar. By clamping the oil circuit breaker in at any of these positions the breaker is operative. There is also an interlock on the oil circuit breaker that requires it to be in open position before the motor mechanism is operative.

From the transmission feeder reactors on each of the phase floors, single-conductor 400,000-circ.mil concentric stranded cable is run with $\frac{13}{32}$-in. varnished-cable insulation, $\frac{1}{8}$-in. lead.

The lead sheath is further insulated against circulating currents by means of a special outer covering consisting of two layers of 8-oz. duck tapes applied with a lap and thoroughly filled with an asphalt compound. This cable enters the pothead on the ground and test switches on the ground floor of the switch house. From the pothead on these switches a T connection is made, from which point the outgoing transmission feeders are run.

The outgoing feeders consist of three-conductor, 350,000-circ.mil sector paper-insulated, lead-covered cable. The conductors are insulated with $\frac{29}{64}$-in. paper insulation and a belt insulation of $\frac{19}{64}$ in., with a lead sheath of $\frac{3}{32}$ in. These cables are rated at 33,000-volt operation, but are operating at 27,600 volts.



INTERIOR OF TURBINE HALL, SHOWING A G.E. UNIT IN THE FOREGROUND AND THE WESTINGHOUSE UNIT UNDER CONSTRUCTION, WITH A 6,000-KVA., 2,300-VOLT HOUSE TURBINE BETWEEN

The auxiliary power is supplied at 2,300 volts, three-phase, 60 cycles, 440 volts, three-phase, 60 cycles, and 250 volts direct current. All main auxiliary motors above 50 hp. are run from the 2,300-volt source with the exception of the boiler auxiliaries. This 2,300-volt source for each pair of main units is supplied from one 6,000-kva., 25/60-cycle frequency changer connected to the old 25-cycle station, one 6,000-kva. house turbine and one 6,000-kva., three-phase, 27,000/2,300-volt house transformer fed from the main station buses.

Between the transformers and the 2,300-volt bus are 14 per cent reactors in order to keep up the voltage on this bus in the event of trouble in the transformers

or on the main station bus. The three sources of power are so connected to the bus and the bus itself is so sectionalized as to insure maximum continuity of service for the major auxiliaries and a somewhat less degree of continuity for the minor auxiliaries.

These motors are designed for full-voltage starting with few exceptions. The oil circuit breakers for feeding the individual motors are of the steel-truck type. The 2,300-volt buses are inclosed in the housing for these trucks.

All the 2,300-volt station cable consists of either single-conductor or multi-conductor cable incased in lead sheath. For cables of 500,000 circ.mil and larger the lead sheaths are insulated against circulating current by means of a duck tape filled with an asphalt compound over the lead sheath. On the low-tension cables, except for control cable, there are no distinctive features other than that lead sheath is used wherever practicable.

All motors below 50 hp., alternating-current driven, are induction-motor type with compensator starting. The 440-volt buses and switchboard are inclosed in steel-type compartments. The switches are of dead-front knife-switch, quick-break type. The variable speed boiler auxiliaries, such as the stoker motors, clinker grinder motors, etc., are 250 volts direct-current controlled by the Ward Leonard method. These are driven from a four-unit set consisting of a 1,000-kw. direct-current 250-volt generator, a 300-kw. direct-current 250-volt generator, a 100-kw. direct-current exciter and a 1,725-hp., 2,300-volt, three-phase, 60-cycle synchronous motor for driving the three direct-current generators.

Starting and synchronizing is automatic, and an automatic low-voltage control scheme is applied which reduces the load when the voltage drops and re-establishes normal conditions when it returns to normal. The direct-current switchboards for these auxiliaries are of vertical switchboard type equipped with single-pole circuit breakers mounted one over the top of the other.

Excitation for the main units is provided by 300-kw., 250-volt direct-connected exciters and an excitation bus with a 2,000-amp., one-hour storage battery and two 600-kw. motor-generator sets for the whole station. Reverse-current protection insures against interruption of main unit excitation in the event of trouble at any point. The battery may also be used for emergency lighting.

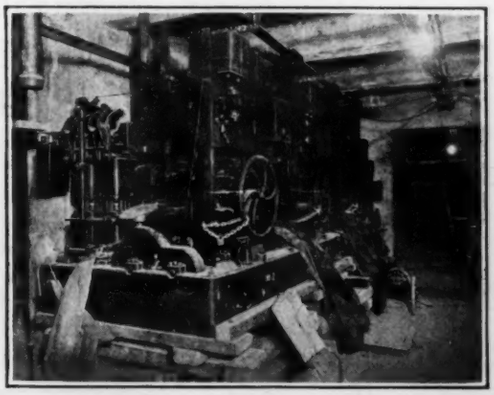
Control of the main 26,400-volt switching equipment is installed in the seventh floor of the switch house. These switchboards are steel cubicles, and the housings are built to extend through the floor with their terminal blocks in this position, so that they are easily accessible for wiring purposes on the cable floor. The feeder and generator relay panels are of the vertical type. The generator control is of benchboard type. The meters and relays all have black faces with white-scale markings. The feeder and generator cubicles are arranged in an oval form, and in the center is an operator's desk.

The 2,300-volt control switchboards are also of the cubicle type, but in this case do not extend below the floor, the terminal block being accessible at the rear of the cubicles. These cubicles line up in a straight line along the building wall.

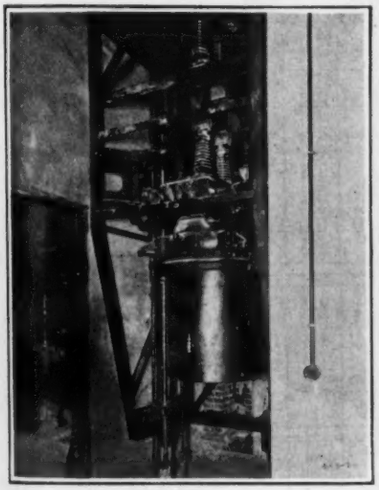
The control cable consists of multi-conductor cable, the standards used being seven-conductor, twelve-conductor, nineteen-conductor and thirty-conductor. These conductors are rubber-insulated, using a 30 per cent rubber compound, each conductor having a distinctive colored braid for identification. The special color scheme is used throughout. The multi-conductors are covered with a layer of tape and lead sheath.

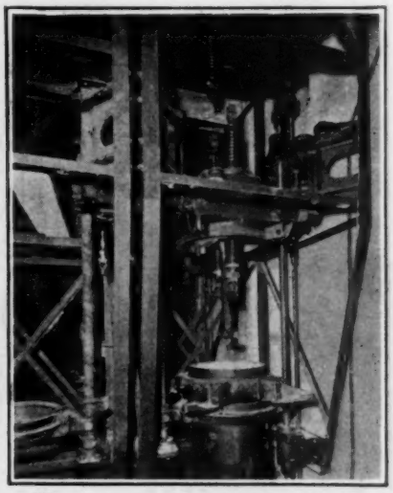
Control power is supplied at 125 volts direct-current from 50-kw. motor-generator sets, with two 480-amp., one-hour emergency storage batteries for the com-

At Right — Oil-breaker-operating mechanism on the fifth floor of the switch house for operating breaker group shown in the illustration below it.

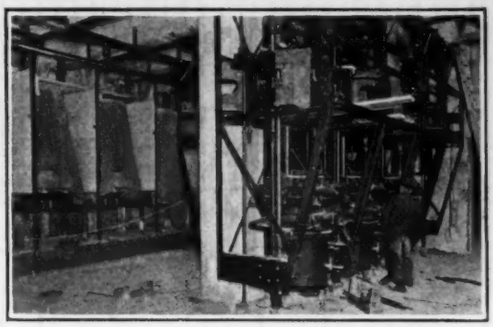


Below—One pole of the 2,000-amp., 37,000-volt, 1,500,000-kva. isolated-phase generator circuit breakers in the open position.





Above—One pole of 600-amp., 37,000-volt, 1,500,000-kva. feeder breakers under construction. It is shown disconnected with the tanks lowered for inspection of contacts.



At Left—A compartment of feeder breakers in the switch house. Motor-operated controls raise and lower tanks very readily.

UNUSUAL BREAKER ARRANGEMENTS INSURE RELIABLE SERVICE

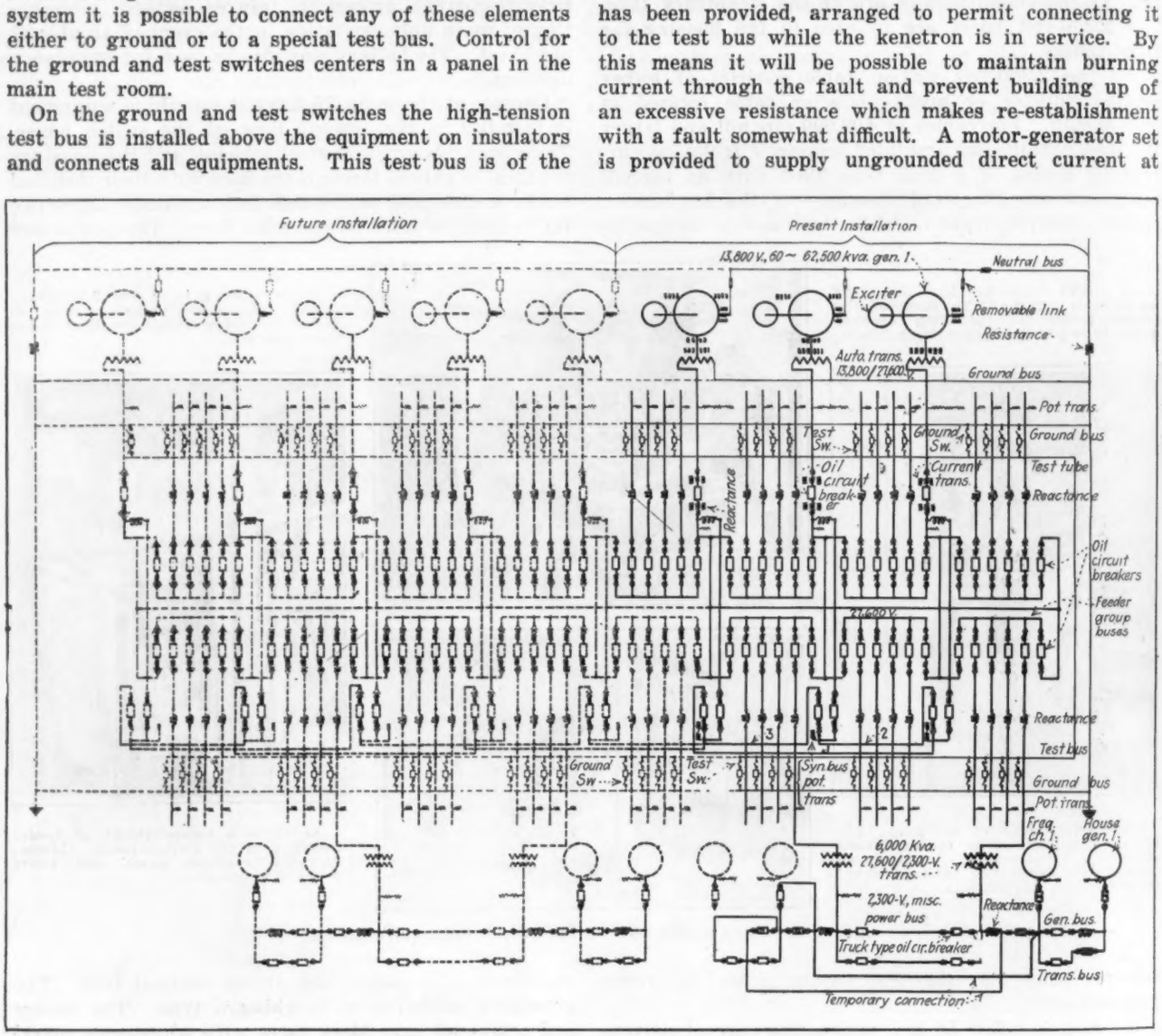
pleted station. The control system is not used for any other purpose, even in emergencies.

The facilities provided for making high-potential tests on feeders and on the principal elements of the power-generating apparatus are somewhat novel. By means of ground and test switches "teed" on to each feeder and generator connection to the 27,000-volt bus system it is possible to connect any of these elements either to ground or to a special test bus. Control for the ground and test switches centers in a panel in the main test room.

On the ground and test switches the high-tension test bus is installed above the equipment on insulators and connects all equipments. This test bus is of the same construction as the 27,000-volt micarta-wrapped tubular bus previously described for the phase floors. The test bus is divided into two sections and brought into the test room where disconnecting switches are arranged to permit connecting either half separately or both together to a short section of bus within the test room. The various testing equipments can be connected to this test bus through "disconnects" in any desired arrangement.

The principal testing will be that on the outgoing feeders and special attention has been given to the selection of the equipment needed for this work. The 200-kv., 20-kva. kenetron test set will be used for most of this work. In addition to the indicating instruments for showing voltage, current, etc., a set of graphic instruments with high-speed charts will be arranged to give records of applied voltage and charging or leakage current. By this means a graphic record will be obtained of the time characteristic of the charging current (Phelps-Tanzer method).

For burning down cable faults after they have been developed by the kenetron or in service, a 150-kva. constant-current transformer for 7.5 amp. or 15 amp. has been provided, arranged to permit connecting it to the test bus while the kenetron is in service. By this means it will be possible to maintain burning current through the fault and prevent building up of an excessive resistance which makes re-establishment with a fault somewhat difficult. A motor-generator set is provided to supply ungrounded direct current at voltages up to 750 for use with the fault location apparatus, which consists of special bridges and tracer current apparatus.



SINGLE-LINE DIAGRAM OF MAIN 27,000-VOLT CONNECTIONS
Unit feeding of a group of feeders is the normal practice.

For testing the main generators a 500-kva. single-phase testing transformer with double winding secondary to give 40 kv. or 80 kv. to ground has been provided. This set will also be available for alternating-current testing on apparatus requiring voltages within this limit.

The test lead from the test transformer consists of single-conductor No. 1 A. W. G., stranded, placed around a $\frac{3}{4}$-in. rope core. This conductor is insulated with $\frac{22}{32}$-in. varnished cambric insulation and covered with a lead sheath $\frac{1}{4}$ in. thick. This cable is used up to a range of 100,000-volt test.

The large number of relays and instruments dis-

tributed throughout the station has made it desirable to install a central test room for handling all tests on this class of equipment. This room will be provided with transformers, regulators, motor-generator sets, secondary standards, relay-test equipment and other accessories. One hundred and sixty two-wire test circuits lead out from a plug panelboard in this test room to various parts of the station where meters, relays or instruments may have to be tested. In practically every case the terminal board is within 10 ft. of the meter or relay. By the use of one pair of wires as a communication circuit and suitable head and breast telephones the men in the test room will keep in communication with the tester located at the switchboard.

Signaling System

The systems for signaling and intercommunication have been laid out so that operations may be carried on with a minimum of verbal instructions, signals or other communications.

Indicators which will be remotely controlled from the station totalizing wattmeter will be used to indicate the total load carried at any instant by the main units. These indicators will be used in the high-tension gallery, at the boiler-feed pumps, in the boiler room, in the boiler control room and in the chief engineers' office. These indicators will be used to guide various operators in starting and stopping boiler-room auxiliaries and in the general operation of the boiler room. Frequency will be maintained by following the indications of a Warren clock, which will be energized by potential transformers on the 27,000-volt bus.

Special desks are provided for the high-tension and low-tension operators and will have built into them an intercommunicating telautograph for insuring a record of important orders passing between them. These desks are also provided with a special fifteen-line telephone switchboard to take care of the direct telephone communications. In addition to the foregoing equipment, these desks are provided with telephone drops which will indicate the loss of auxiliaries. The high-tension operators' desk will give an indication only of the loss of essential auxiliaries. The drops on the low-tension operators' desks will indicate the loss of any 2,300-volt auxiliary or feed from the 2,300-volt bus.

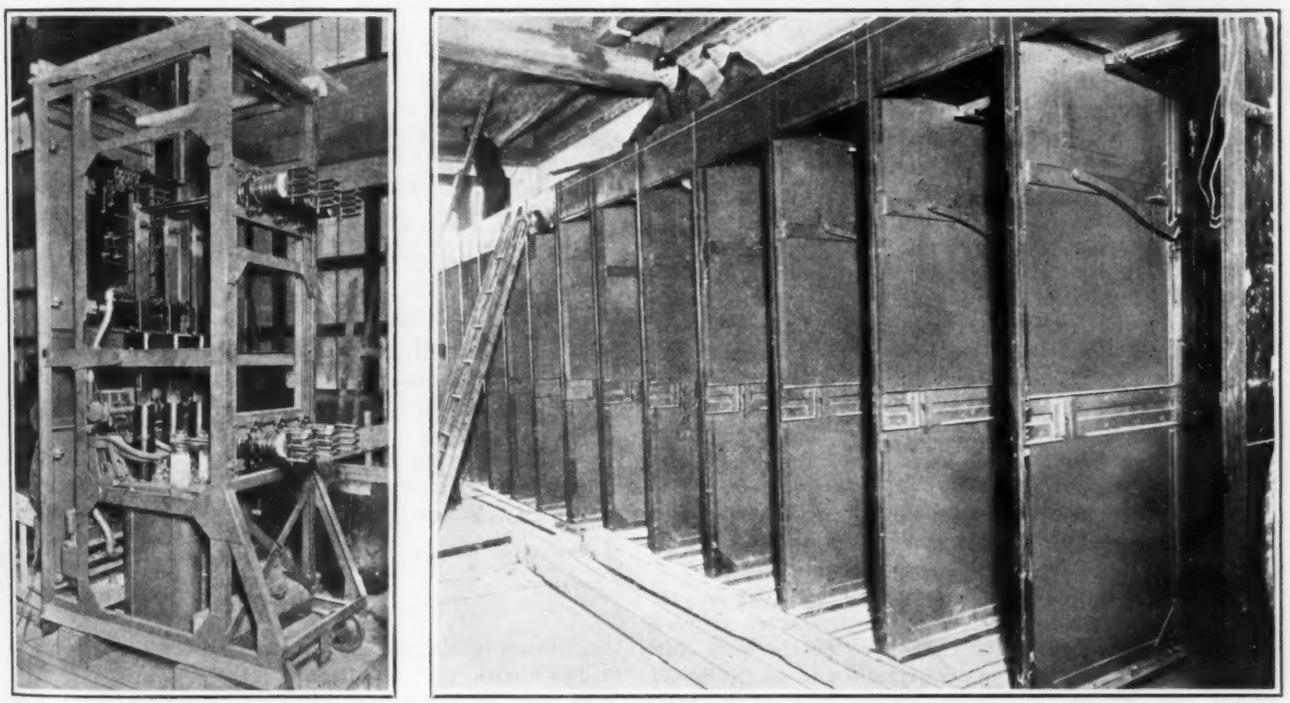
Ventilation of Electrical Building

For auto-transformers incoming air is drawn from outside through screens at the bottom of the transformer to the transformer vaults; then it passes around the transformers and exhausts by natural draft through chimneys extending through the roof of the electrical building. One chimney is provided for each bank of three auto-transformers. This ventilation is designed to prevent a greater temperature rise than 25 deg.

In the machinery room ventilation is accomplished by drawing air from Marshall Street through stationary louvers in the ventilating floor immediately under the machinery room. This air passes through openings in the machinery room floor through and around the 6,000-kva. frequency changers and is exhausted through stacks in the roof.

Incoming air to the switch galleries is drawn from outside through a corridor which is heated in winter. This air passes from the corridor up flues in both walls with floor inlets under the reactor platforms in the various switch rooms. Air from each switch room passes out at the ceiling to flues exhausting through the roof by natural draft.

The mechanism room has no artificial ventilation but has windows which may be adjusted according to existing requirements. Provisions have been made for outlet receptacles so that local electric heaters may be installed in winter. Likewise the high-tension control room is provided with windows to the outer air and has



SAFETY TRUCK INSTALLATION ON 2,300-VOLT SERVICE
Left—A 2,300-volt cubicle truck for use in the switch cells. Right—View of 2,300-volt switch cells.

radiators for heating in winter. The low-tension control room receives air from ducts leading from the cold air corridor. Air is exhausted by fans into chimneys extending through the roof.

LIGHTING OF STATION

Under normal conditions all lighting will be done at 120-volts, 60 cycles. Should the source of alternating current supply fail, a portion of the lighting units will be supplied by direct current from the station excitation battery by means of an automatic transfer switch.

The entire lighting system will be controlled from three switchboards, each having a "normal" and an "emergency" section:

The main lighting switchboard, on the fifth floor of the electrical building, will control all lighting in the electrical building and feeders running to auxiliary lighting switchboards. One auxiliary lighting switchboard on the basement floor of the boiler house will control all lighting in the boiler house complete, coaling system, dock and screen well. The second auxiliary switchboard, on the basement floor of the turbine house, controls all lighting in the turbine house complete and in the service building, as well as the street lights inside the walkway bridges and under all bridges crossing Marshall Street from the turbine house to the electrical building.

General lighting of the turbine room is accomplished by 1,000-watt deep-bowl reflector units placed on the bottom of the roof trusses. Two-thirds of these units will remain lighted in case of emergency. General lighting of the boiler house is accomplished by steel-reflector units. Approximately 20 per cent of the general lighting, all gage lights and other important lights will remain lighted in emergency conditions. Inside the ash trough lighting has been installed for the purpose of convenient observation and to facilitate any necessary work that may be required.

Only a small percentage (about 10 per cent) of the general coal-handling lighting will remain lighted in emergency, these few lighting units being installed at proper points in the coaling system, on the dock and on stairs or walkways sufficient to enable operators to move safely about. Flood lighting installed on the dock side of the boiler house, on the coal trestle and on the boom of the coal towers gives ample illumination of the ash-handling operations, docks, movement of barges and all movements of the coal bucket at all times. Screen wells and hoists will be lighted by floor lights placed to the best advantage.

The arrangement of oil circuit breakers and reactors on the switching floors in long narrow aisles necessitates means of providing as nearly as possible uniform illumination. "Four-way" refractor-type street-lighting units have been so modified that the desired result is obtained. These units each contain one 150-watt lamp, and the units are mounted rigidly so that the axes of the light beams are practically 45 deg. from the center line of the aisle. In the auxiliary machinery room general lighting is obtained by means of deep-bowl reflector units mounted on the ceiling. Approximately two-thirds of these units will remain lighted in case of emergency.

The high-tension and low-tension control rooms in the electrical building, as well as the centralized boiler control room in the boiler house, have a very distinctive scheme of lighting. Each of these three rooms has a drop ceiling above which are mounted the lighting units. The general lighting of each control room is obtained by means of symmetrical reflector units, each of which is flush with a drop ceiling and is mounted on a glass plate having a "pebble" or irregular surface which gives uniform distribution of the light without any noticeable image or bright spot due to the lamp filament. For illuminating the control switchboards the desired intensity is obtained on both the vertical panel sections and the benchboard by means of angular or asymmetrical reflectors mounted in an angular position above the drop ceiling, and across the face of each reflector is placed a panel of prismatic glass in such manner that the light is directed to the best advantage over the control boards. These angular reflectors are mounted in front and on the center line of each control board and at such distances from the front of the board that the operator will not see any image of the lighting unit and that there will be no glare on any instrument mounted on the board.

LIGHTING INTENSITIES USED IN HUDSON AVENUE STATION

	Foot-Candles
Boiler House	
Firing aisles	5
Ash cellar	3
Coal bunker, track level	3
Forced-draft level	3
Walkways, stairways, etc.	2
Mechanical equipment (machinery)	6
Turbine House	
Turbine floor	3
Auxiliary cellars, etc.	3
Passageways, stairs, etc.	3
Mechanical equipment (machinery)	6
Electrical Galleries	
Switchboards, cubicles, etc.	6
Mechanism floor	6
Switch galleries	6
Auxiliary machine floor	6
Control rooms (operator's desks)	10
Transformer rooms	3
Walkways, stairs, etc.	2
Service House	
Walkways and stairs	2
Locker rooms, etc.	4
Office space, etc.	10
Shops	12
Hospital	15
Coal Towers	
Machinery rooms	6
Tracks	3
Docks and Screen Wells	2
Ash Pit	2
Marshall Street Bridges	
Interior walkways	2
Exterior (underneath)	2

In case of emergency all lighting units which illuminate the control boards as well as a suitable number of general lighting units in the control rooms will remain lighted.

GOOD ILLUMINATION ADVISABLE

In general it has been thought desirable to provide illumination of perhaps more than the average intensity found in most central stations, in order that, under normal operating conditions, absolute safety from this point of view would be provided to the operators, as well as to insure them ample illumination for the operations to be performed. The amount of lighting in emergency, when the regular supply fails, was planned in the same way, yet without going to excess. For the entire station so far completed the emergency lighting load amounts to about 22 per cent of the total lighting load.

The foot-candle intensities under normal lighting conditions were determined upon and provided as was believed best suited to safety and operation conditions. These foot-candle intensities are shown in the accompanying table.

New England's Power Needs

Growth of Public Utility Energy Supply Through Expansion and Interconnection of Steam and Hydro-Electric Systems Will Meet Major Requirements of the Northeast for Many Years—Canadian Power Expected to Find Profitable Future Market

DIVERSIFIED industrial development and a steadily rising standard of living in New England are multiplying the demands for electrical service so rapidly that about a year ago an investigation of the power resources of the Northeast was undertaken by the Associated Industries of Massachusetts through a committee of eminent engineers and business leaders. This committee has just made a most comprehensive report on the subject, emphasizing the enormous importance of the central station and of interconnection in the solution of power problems, the great achievements of hydro-electric and steam-electric energy in vitalizing the mighty industrial structure of this section and the assured resources of electrical engineering in facing future regional power requirements. The committee consisted of Charles T. Main, consulting engineer, Boston, chairman; Prof. D. C. Jackson, senior partner Jackson & Moreland, Boston, and head of the department of electrical engineering, Massachusetts Institute of Technology; H. I. Harriman, president New England Power Company, Boston; G. L. Finch, consulting engineer, Boston, and B. P. Clark, vice-president Plymouth Cordage Company, Boston. George C. Danforth, former chief engineer of the Maine Water Power Commission, was engaged to contribute an analysis of the power situation in Maine, New Hampshire and Vermont, and Karl R. Kennison, consulting engineer, Boston, was employed to analyze and co-ordinate engineering reports and data in the interests of combining condensation with an adequate treatment of the problem. The report covers only 183 pages, but it constitutes one of the most complete surveys of power supply for a group of states ever made public. The committee contributed its services to the inquiry, and a large group of business establishments shared the incidental expenses.

Industrial Growth of New England

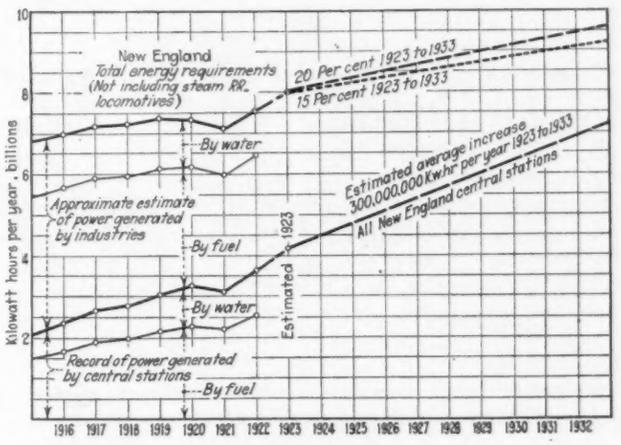
The indications are that the growth of New England power requirements will be from 15 to 20 per cent in the next ten years, this estimate being based on industrial, transportation and population data. The total installed power for all industries in 1922 was 1,790,000 hp. A selected group composed of woolen, paper, dyeing and finishing and rubber industries, using process steam extensively, totaled 471,000 hp. This group purchased only 27 per cent of its power, and this ratio has held about constant for several years. The remaining industries were purchasing 42 per cent of their power, and the ratio of purchased power is still increasing.

TABLE I—SUMMARY OF NEW ENGLAND CENTRAL-STATION GENERATING CAPACITY
(In operation or under construction December, 1923)

	Kva.		
	By Water	By Fuel	Total
Maine, including two plants just over the New Brunswick line	114,465	27,660	142,125
New Hampshire	49,610	32,700	82,310
Vermont, including two plants just over the New York line	79,865	13,200	93,065
Massachusetts	104,970	1,023,245	1,128,215
Rhode Island	1,750	188,960	190,710
Connecticut	45,740	365,110	410,850
Total	396,400	1,650,875	2,047,275

Central-Station Development

In 1915 the central stations (including traction plants) of New England generated 2,058,000,000 kw.-hr., of which 1,498,000,000 kw.-hr. was produced from fuel. This production grew to 3,643,000,000 kw.-hr. in 1922, with 2,546,000,000 kw.-hr. generated from fuel, and the 1923 estimate of total production is 4,200,000,000 kw.-hr. The average annual increase was 6.1 per cent

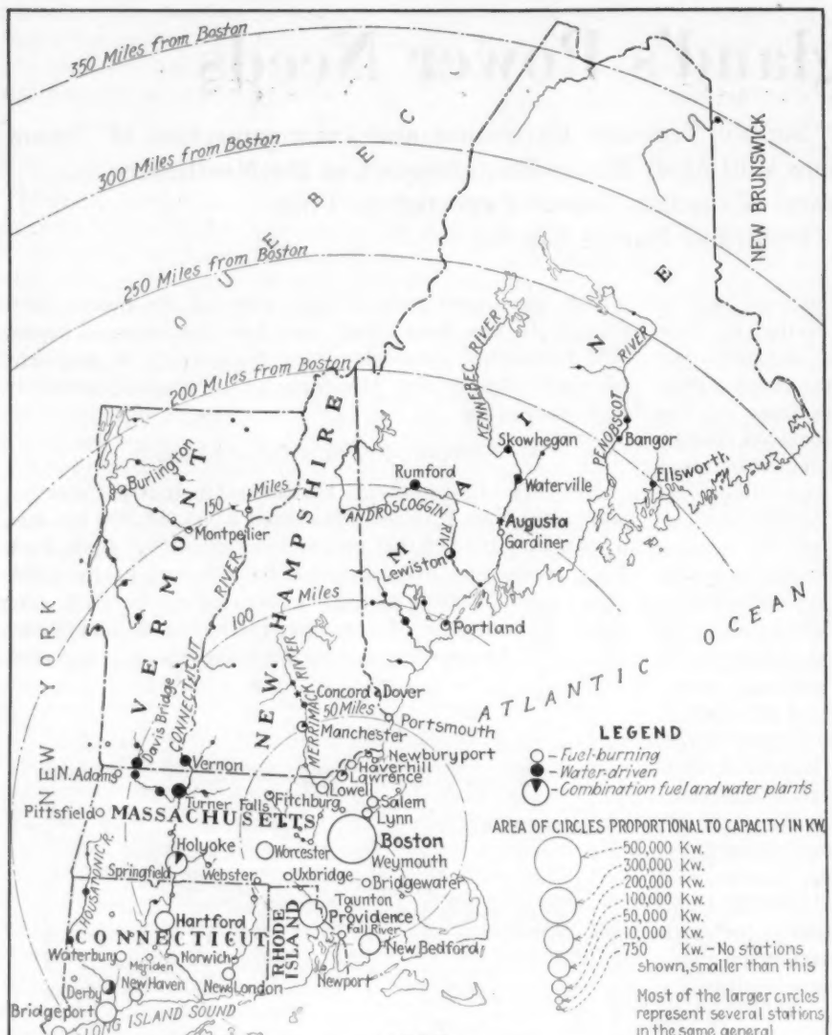

New England
Total energy requirements
(Not including steam RR. locomotives)
20 Per cent 1923 to 1933
15 Per cent 1923 to 1933
By water
Approximate estimate of power generated by industries
By fuel
By water
Record of power generated by central stations
By fuel
Estimated
1923
Estimated average increase 300,000,000 Kw.hr per year 1923 to 1933
All New England central stations
Kilowatt hours per year, billions
10
8
6
4
2
1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932

GROWTH OF NEW ENGLAND POWER REQUIREMENTS IN KILOWATT-HOURS PER YEAR

in fuel-generated power and 7 per cent in hydro-electric power.

For the interconnected utilities in the Massachusetts-New Hampshire-Rhode Island group the estimated growth of total power in the next decade is at the rate of about 190,000,000 kw.-hr. per year, and for all New England, about 300,000,000 kw.-hr. per year. The increased capacity needed by central stations at the end of the next ten years will be nearly 1,400,000 kw. in addition to replacements and not including any allowance for extended railroad electrification. It is estimated that if 1,295 miles of important lines should be completely electrified by 1935-40, the annual energy requirements would be about 2,000,000,000 kw.-hr., the station generating capacity needed about 1,000,000 kw., with an annual saving in coal from electrified operation of more than 3,000,000 tons. Lines already electrified are using more than 160,000,000 kw.-hr. yearly, but on account of the difficulties of financing railroad electrification only a nominal allowance for power for this work has been made in the report.

The estimated average horsepower in operation generated by New England industrial power plants in 1922



CAPACITY OF GENERATORS IN ALL NEW ENGLAND CENTRAL STATIONS
(CLASSIFIED AS STEAM AND HYDRO)

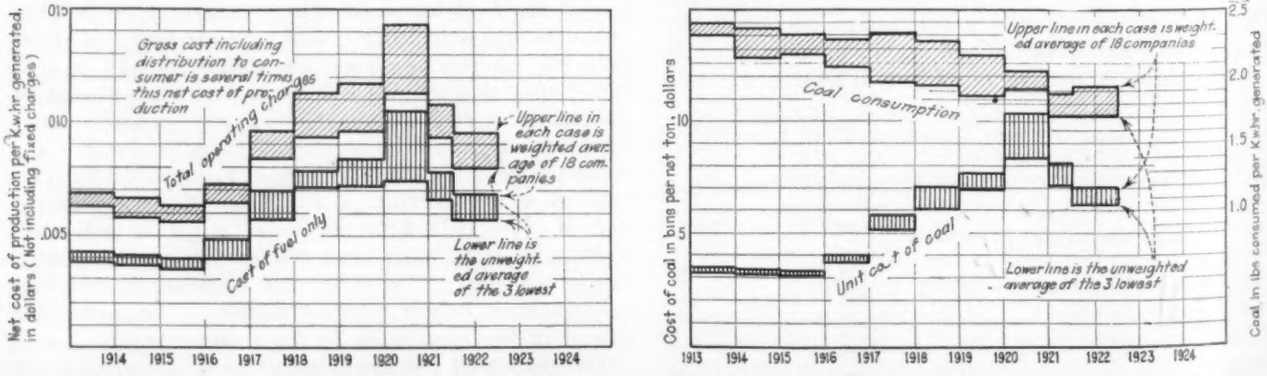
was 1,230,000 by fuel and 475,000 by water. The annual load factor, taken at 35 per cent, was associated with an estimated production in these plants of 2,820,000,000 kw.-hr. by fuel and 1,090,000,000 kw.-hr. by water, compared with 3,480,000,000 kw.-hr. by fuel and 1,380,000,000 kw.-hr. by water in 1914. The estimated grand total energy requirements for New England for 1922, excluding steam locomotives, were 4,200,000,000 kw.-hr. generated by central stations and 3,800,000,000 by industries, a combined output of 8,000,000,000 kw.-hr.

The total capacity of all central-station plants in New England is 2,047,000 kw., of which 81 per cent is in fuel-burning plants and the remainder hydro-electric. About 25 per cent of the total capacity is on the Boston Edison and New England Power company systems, and in general the New England central-station load is concentrated in eastern and southern Massachusetts, Rhode Island and Connecticut and is largely steam power. Table I summarizes the above for the New England States.

The consumption of fuel for industrial purposes in large quantities in general centers in the Providence-New Bedford-Fall River, the Lawrence-Lowell and the Boston districts, and the industrially owned fuel-consuming plants in these centers include nearly 40 per cent of the corresponding total for New England. In Massachusetts alone about 35 per cent of the total industrially owned power plants using fuel is in industries making important use of process steam. Other sections, and of course many localities within the above territory, are making increased use of central-station power with the passage of time and the vigorous development of utility service along economic lines.

The water-power resources of New England are small in comparison with the power requirements which are met by burning fuel. Even if the legal restrictions on power exportation from Maine were removed, the high cost of development and transmission would prevent the sale of a large proportion of this power outside that state. Most industries will not move to the location of cheap power, however, because the cost of power is a relatively unimportant item in the total cost of industrial production in New England. Table II summarizes the developed water powers of over 100 hp. rating.

The total undeveloped water power of 1,000 hp. or over on the principal streams of New England amount to 864,990 hp., available 60 per cent of the time. About 75 per cent of the sites are in Maine. They are shown in Table III.

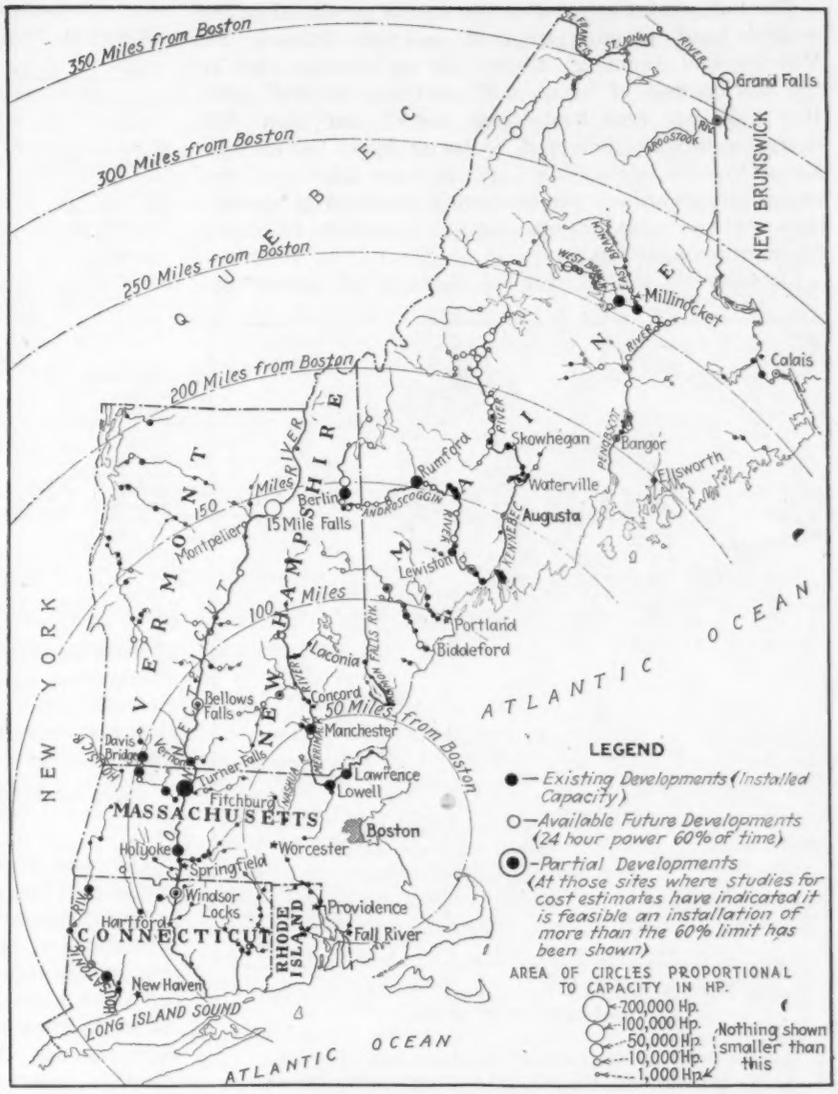

Net cost of production per K.w.hr generated, in dollars (Not including fixed charges)
.015
.010
.005
Gross cost including distribution to consumer is several times this net cost of production
Total operating charges
Upper line in each case is weighted average of 18 companies
Cost of fuel only
Lower line is the unweighted average of the 3 lowest
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924
Cost of coal in bins per net ton, dollars
Coal consumption
Unit cost of coal
Upper line in each case is weighted average of 18 companies
Lower line is the unweighted average of the 3 lowest
Coal in lbs consumed per K.w.hr. generated
2.5
2.0
1.5
1.0
1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924

COST OF STEAM-ELECTRIC PRODUCTION IN NEW ENGLAND CENTRAL STATIONS

Through modernization of existing developments it is estimated that about 25 per cent more power can be obtained by equipment improvements only, in the case of plants built before 1900, and often a more complete development will add 10 to 20 per cent more.

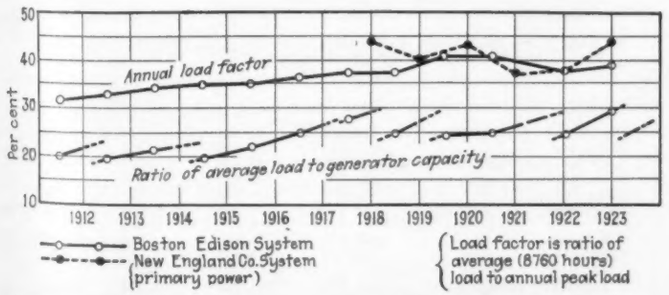
Detailed tables of the undeveloped water-power resources on the major New England rivers amounting to 1,000 hp. available 60 per cent of the time are included in the report. The total amount of such power is about 860,000 hp., possible of developing 4,830,000,000 kw.-hr. per year.

The amount of water flowing in this region varies within wide limits, maximum stages of two hundred times the minimum occurring frequently. Auxiliary steam power has generally been necessary. If all the above undeveloped powers could be developed by adequate pondage for a 50 per cent load factor, this would require an installed capacity of about 1,720,000,000 hp., and the cost of such developments would vary between $50 and $500 per hp. for land and water rights, changes in roads and railroads and the power plant and structures up to the outgoing lines. These costs of development would be less than $100 per horsepower for about 45 per cent of the total and between $100 and $150 per horsepower for an additional 25 per cent of the total. Of the total 4,830,000,000 kw.-hr. potentially available, it is estimated that nearly 3,000,000,000 (nearly all of which would be generated in Maine) would be delivered to industries taking large blocks at a cost from 0.7 cent to 1.5 cents per kilowatt-hour.

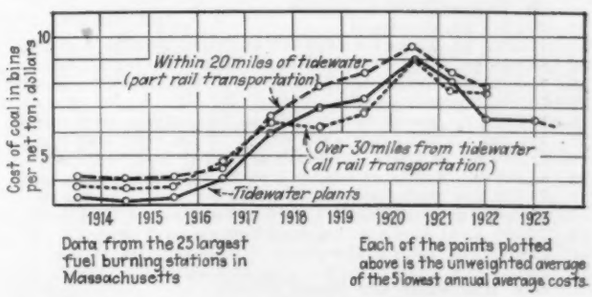


DEVELOPED AND UNDEVELOPED WATER POWERS IN NEW ENGLAND

Within 500 miles of Boston is about 10,000,000 estimated continuous horsepower on the St. Lawrence and principal rivers of Quebec, and investigations show that it is entirely possible to transmit the nearer blocks of Quebec power to Massachusetts without excessive losses and with sufficient reliability and stability. Of this total, about 5,000,000 hp. is on the St. Lawrence in three important sites within 250 miles of central Massachusetts, which would mean the delivery of 20,000,000,000 kw.-hr. to 25,000,000,000 kw.-hr. yearly. No large amount of power could be hoped for inside of eight years on account of the international aspects and engineering magnitude of the problem. It would not now be economical to bring such power to Massachusetts from so far except in large quantities, such as 1,000,000,000 kw.-hr. per year on a load factor of 50 per cent or better, with the market open for its absorption within a year or two after the delivery began. While an exact figure cannot be determined at which energy could be sold, it is safe to say that the cost of Canadian power will be such as to justify its importation in spite of the expected efficiencies and decreased labor costs of future steam stations at tidewater. These are needed to assure reliability of supply and to obtain the necessary high load factor for the imported power.


Per cent
50
40
30
20
10
Annual load factor
Ratio of average load to generator capacity
1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
Boston Edison System
New England Co. System (primary power)
Load factor is ratio of average (8760 hours) load to annual peak load

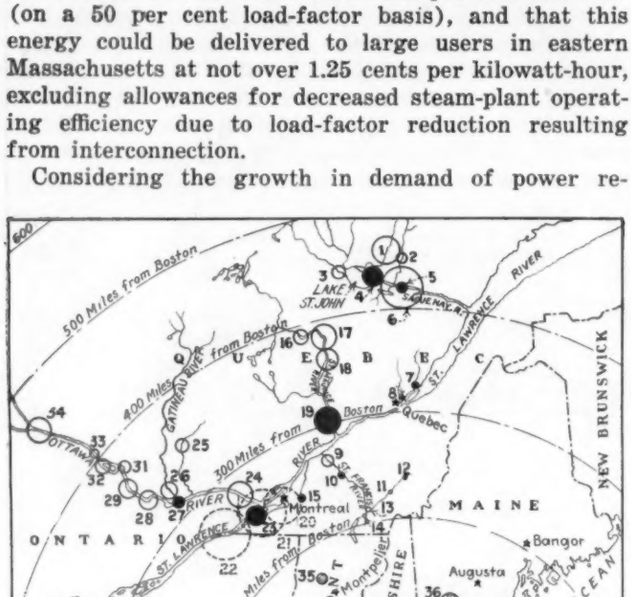
ANNUAL LOAD FACTOR IN TWO OF THE LARGEST POWER SYSTEMS IN NEW ENGLAND


Cost of coal in bins per net ton, dollars
10
5
Within 20 miles of tidewater (part rail transportation)
Over 30 miles from tidewater (all rail transportation)
Tidewater plants
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
Data from the 25 largest fuel burning stations in Massachusetts
Each of the points plotted above is the unweighted average of the 5 lowest annual average costs

COST OF COAL DELIVERED TO MASSACHUSETTS CENTRAL STATIONS

The indications are that power can be produced at the medium-head plants projected on the Ottawa, St. Maurice and Saguenay Rivers for an average cost at the station bus of about 0.35 cent per kilowatt-hour (on a 50 per cent load-factor basis), and that this energy could be delivered to large users in eastern Massachusetts at not over 1.25 cents per kilowatt-hour, excluding allowances for decreased steam-plant operating efficiency due to load-factor reduction resulting from interconnection.

Considering the growth in demand of power requirements, replacement of steam-power plants due to obsolescence and the uneconomical equipment still in use, it would appear that 1,000,000,000 kw.-hr. could be absorbed from Canada by New England within a reasonably short period.



POWER POSSIBILITIES IN CANADA ON THE ST. LAWRENCE AND TRIBUTARY RIVERS

1. 290,000 hp. available (580,000 at 50 per cent load factor).
2. 30,000 hp. available (60,000 at 50 per cent load factor).
3. 60,000 hp. available (120,000 at 50 per cent load factor).
4. 300,000 hp. developed.
5. 75,000 hp. developed at three sites on the three tributaries.
6. 600,000 hp. available (1,200,000 hp. at 50 per cent load factor).
7. 24,000 hp. developed.
8. 8,000 hp. developed.
9. 60,000 hp. available (120,000 at 50 per cent load factor).
10. 17,500 hp. developed.
11. 3,700 hp. developed.
12. 4,000 hp. developed.
13. 8,800 hp. delevoped.
14. 4,700 hp. developed at two sites.
15. 24,800 hp. developed.
16. 76,000 hp. available (152,000 at 50 per cent load factor).
17. 206,000 hp. available (412,000 at 50 per cent load factor).
18. 162,000 available (324,000 at 50 per cent load factor).
19. 527,000 hp. developed at three sites.
20. 1,000,000 hp. available as part of St. Lawrence canal project.
21. 1,900,000 hp. available as part of St. Lawrence canal project (would wipe out existing development of 245,000 hp., leaving 1,655,000 hp.).
22. 2,000,000 hp. available on international boundary as part of St. Lawrence canal project.
23. 245,000 hp. developed.
24. 220,000 hp. available (440,000 at 50 per cent load factor).
25. 65,000 hp. available (130,000 at 50 per cent load factor).
26. 100,000 hp. available (200,000 at 50 per cent load factor).
27. 80,000 hp. developed.
28. 120,000 hp. available (240,000 at 50 per cent load factor).
29. 120,000 hp. available (240,000 at 50 per cent load factor).
31. 64,000 hp. available (128,000 at 50 per cent load factor).
32. 84,000 hp. available (168,000 at 50 per cent load factor).
33. 28,000 hp. available (56,000 at 50 per cent load factor).
34. 200,000 hp. available (400,000 at 50 per cent load factor).
35. 70,000 total fuel-burning installations in Vermont.
36. 210,000 hp. total fuel-burning installations in Maine.
37. 2,915,000 hp. total fuel-burning installations in Massachusetts, New Hampshire and Rhode Island.
38. 825,000 hp. total fuel-burning installations in Connecticut.

TABLE II—DEVELOPED WATER POWERS IN NEW ENGLAND RATED AT 100 HP. OR MORE

State	Installed Hp.	Corresponding Million Kw.-Hr per Year
Maine	464,130	900
New Hampshire	245,295	475
Vermont	139,821	272
Massachusetts	349,079	675
Rhode Island	30,286	58
Connecticut	134,679	260
Total	1,363,290	2,640

TABLE III—UNDEVELOPED WATER-POWER SITES IN MAINE

River Basin	Hp. Capacity Available 60 per Cent of Time	Corresponding Million Kw.-Hr. per Year
St. John	38,830	200
St. Croix	19,455	110
Machias	2,390	12
Penobscot	236,605	1,325
Kennebec	222,670	1,295
Androscoggin	115,730	668
Saco	29,440	150
Merrimack	27,290	170
Connecticut	141,250	735
Lake Champlain	9,100	49
Quinebaug	3,240	17
Housatonic	18,990	99
Total	864,990	4,830

COST OF FUEL-BURNING POWER IN NEW ENGLAND INDUSTRIAL PLANTS

The cost of power on the switchboard in 1923 in textile-mill steam plants operating 2,400 hours a year ranged from 2.84 cents to 1.67 cents per kilowatt-hour in stations of from 1,000 kw. to 10,000 kw. rating with coal at $8 per short ton and from 2.56 cents to 1.58 cents per kilowatt-hour over the same plant sizes with oil at $1.80 per barrel. For each $1 change in coal cost per ton there was a change of 0.15 cent per kilowatt-hour for a 1,000-kw. plant to 0.10 cent for a 10,000-kw. station. In woolen and worsted mills, where all of the exhaust steam and condenser overflow are used in process work, the net cost ranged from 1.35 cents to 0.87 cent per kilowatt-hour in plants of 500 kw. to 3,000 kw. rating. Paper-mill steam plants, running 144 hours per week, produced power at from 1.84 cents to 1.13 cents per kilowatt-hour in 1,000-kw. to 10,000-kw. installations.

COST OF CENTRAL-STATION STEAM POWER

The average net production cost, not including fixed charges, in all steam-driven New England central stations (with a few exceptions) which generated more than 20,000,000 kw.-hr. in 1922 was 9.5 mills per kilowatt-hour generated, and the gross cost to the

TABLE IV—DEVELOPED WATER POWER ON PRINCIPAL RIVERS OF NEW ENGLAND

River	Hp.	Kw.	Million Kw.-Hr. 90 per Cent Power	Tota
Penobscot	114,860	85,600	171	224
Kennebec	101,341	75,600	151	197
Androscoggin	197,525	147,300	295	383
Merrimack	172,174	128,400	257	333
Connecticut	382,658	285,300	571	741
Housatonic	79,892	59,600	119	155
Sub-total	1,048,450	781,800	1,564	2,033
Other rivers	314,840	234,450	468	607
Total New England	1,363,290	1,016,250	2,032	2,640

consumer averaged 3.54 cents per kilowatt-hour distributed and sold. Published rates to large consumers near central stations ranged from 1.69 to 2.46 cents per kilowatt-hour for 500 kw. demand to 1.2 to 1.69 cents for 10,000 kw. demand. During 1923 the keenest buyers paid about $7.50 for all-rail bituminous coal and $6.50 for tidewater coal.

Tidewater stations of 100,000 kw. rating operating with 35 per cent load factor and with coal at $6.25 per short ton can produce electricity at about 1.125 cents per kilowatt-hour at the bus, including fixed charges on an investment of $150 per kilowatt rating. It would seem that power from such large and efficient stations could be sold in large blocks to conveniently located industries for about 1.5 cents per kilowatt-hour, the rate varying according to the amount of energy taken by the customer.

The conclusion of the report is that while it is to the advantage of New England that economically accessible and feasible water powers be developed, both in these states and in Quebec, central-station power distributed by large interconnected systems is the logical source of supply for three-quarters of the growing industrial and domestic loads of the Northeast and that the cost of this power can be kept from increasing only by the early importation of water power capable of relieving fuel-burning stations of a large share of the base load.

A Southern Range Campaign

How 458 Electric Ranges Were Sold by a Central Station in Forty Days—Careful Planning, Enthusiasm and Rivalry Potent Sales Factors—Testimonial Letters from Satisfied Customers

AT THE beginning of 1922 the Southern Public Utilities Company had 624 electric ranges on its lines; at the beginning of 1923 the number had grown to 822, and on April 1, 1923, it was 856. But on May 12, 1923, there were 1,337 ranges in service. By means of a campaign 458 ranges had been sold between April 1 and May 12, and the number on the system increased 50 per cent. And these were bonafide sales, for no range was delivered until a payment of $20 had been made and a contract signed covering the twelve other payments required to complete the purchase.

These statistics show what can be done by an intelligently planned range campaign on a large system with large and small towns having in the aggregate about 27,000 residential customers as "prospects" with a range rate of 4 cents per kilowatt-hour and a two-dollar minimum.

PREPARING THE GROUND

The way was carefully prepared and the plans were made with great care. As a preliminary step all existing ranges on the system were serviced during 1922, obsolete ranges were replaced in many cases, and all ranges were repaired and put in first-class shape. In addition, range users were instructed in the proper use of electric ranges for cooking. As a next step the advice and experiences of manufacturers and range experts were obtained and studied by the executives, and finally branch managers were called to Charlotte, the plans fully outlined to them and their suggestions secured.

The successive steps in the campaign were decided upon and put into execution without delay, and at the end of ten days the enthusiasm had swept into the campaign practically every member of the Southern Public Utilities Company organization. The campaign was planned and sales were made by the existing personnel, and great credit is due to all for putting their shoulders to the wheel.

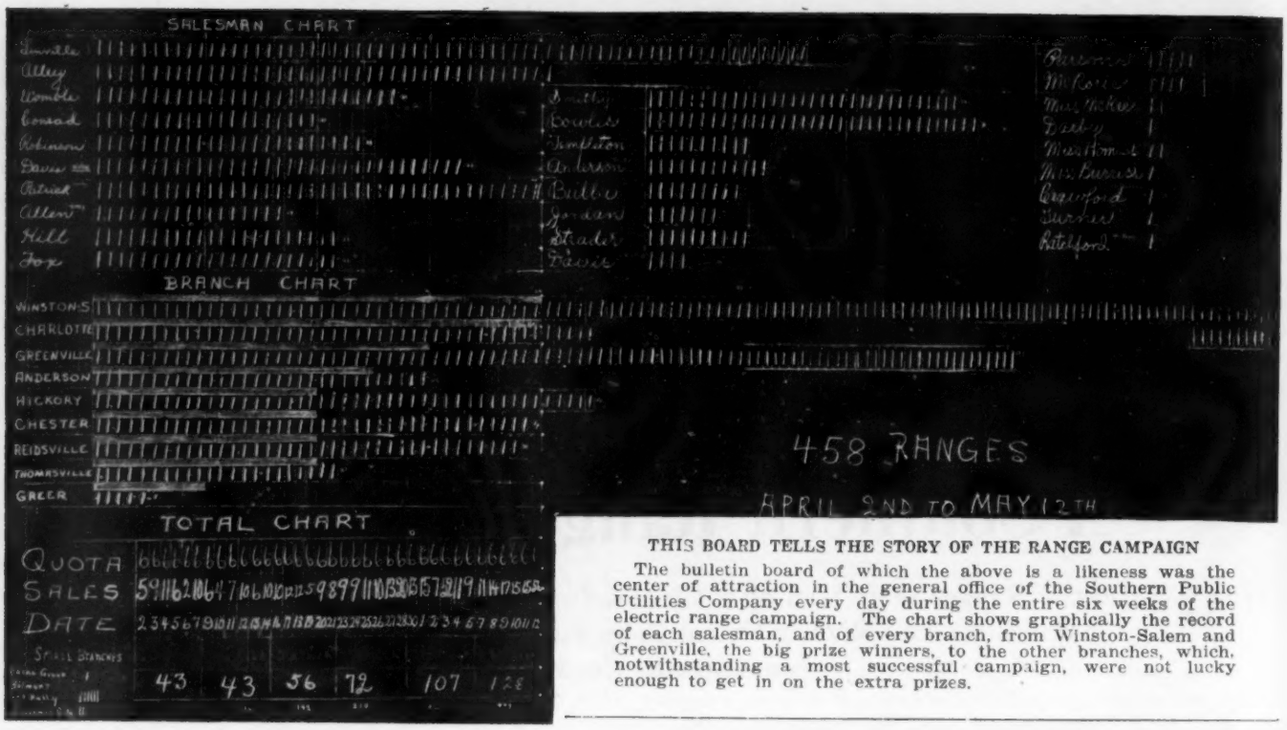
One of the first steps was the sending of a letter to every existing range user on the system. This letter was multigraphed at headquarters in Charlotte and distributed to the branch office managers in the several cities and towns. The managers signed the letters to the consumers in their territory. The letter was thoughtfully prepared and requested users to give a frank expression of their experiences with their electric range and the service rendered by the company. In order to facilitate their reply a blank space was left at the bottom of the letter and a stamped addressed return envelope was inclosed. A large majority of the users returned the letters, and the local managers followed up others by personal calls until almost a 100 per cent expression of opinion had been obtained.

Ninety-eight per cent of the letters expressed unqualified approval of the ranges and of the services. Three typical letters are reproduced here. In the case of complaints a study was made of each case and no difficulty was found in eliminating all the causes of trouble. These letters were bound in portfolios and given to range salesmen to use and proved very effective.

Another step in the campaign was a series of sales letters to "prospects" whose names had been obtained from two sources. One source was the lists worked up by local managers, but by far the most useful lists were obtained from range users. Each range user was requested to give the names of five possible buyers and as an inducement was offered $5 as a prize for each range sold provided that the name of the purchaser was first given by the range user. The returns of this character were stamped as to time and date of receipt, and no difficulty was experienced in using the prize system to very good advantage.

Another constructive step was to instill a spirit of friendly rivalry by setting quotas for each branch and recording at the close of each day's business the sales made in each territory and by each salesman. A weekly statement of results was sent to each branch. As a further stimulus several prizes were offered. A prize of $25 was offered to each branch which completed its quota, one of $100 to the branch which exceeded its quota by the largest percentage and one of $50 for the next highest.

A scoreboard was installed in Charlotte showing the



THIS BOARD TELLS THE STORY OF THE RANGE CAMPAIGN

The bulletin board of which the above is a likeness was the center of attraction in the general office of the Southern Public Utilities Company every day during the entire six weeks of the electric range campaign. The chart shows graphically the record of each salesman, and of every branch, from Winston-Salem and Greenville, the big prize winners, to the other branches, which, notwithstanding a most successful campaign, were not lucky enough to get in on the extra prizes.

quotas for each branch and the records of each salesman at the end of each day. This board became a center of interest to the headquarters staff and proved as magnetic as the world's series baseball scoreboard.

No outside salesmen were used in the campaign, but local staffs joined together to get ranges into service. Regular branch salesmen were used, and in addition stenographers, linemen, office men and others sold ranges. One salesman had the genius to get several range users to put on a neighborhood range demonstration at their homes to which they invited their friends. Needless to say, this man had other ideas, and eventually he headed the list with a total sale of sixty-six ranges during the period of the campaign. Demonstrations of electric range cooking were also held at all local branches. The results of the campaign are indicated in the table.

All branches exceeded their quotas by a large percentage except one where an unusual situation existed which could not be overcome entirely. Eleven salesmen sold more than twenty ranges each, and the total sales were made by twenty-seven employees.

The stimulus given range sales lasted for several months after the campaign, and the results were so great that a similar campaign is being prepared for this spring. In each branch the range business is handled by a specialized salesman who continually services the ranges in the lines and educates range users. Cooking demonstrations are held at branch offices at frequent intervals. The range business has proved very attractive to the company, and the ranges are popular with users. On an average basis, using the 1,337 ranges and including over 100 water heaters, the monthly bill for each consumer is slightly less than $5.50. It is expected that a still more successful campaign will result this year, for the greatest agency for selling ranges is the range user, according to the experiences of the last campaign, which for the size and type of territory covered was one that attained outstanding results.

QUOTAS AND SALES OF RANGES

Branch	Quota	Sales
Winston-Salem	40	134
Greenville	30	91
Hickory	20	45
Chester	20	39
Reidsville	20	38
Charlotte	30	45
Anderson	25	30
Thomasville	20	22
Greer	10	5
Miscellaneous	..	9

Monthly Bill $3.30 for Family of Five

SOUTHERN PUBLIC UTILITIES COMPANY.

Two years ago we purchased an electric range. Words are inadequate to express what it has meant to me, and though I think the value of such conveniences cannot be expressed in dollars and cents, this one has proved economical from a financial standpoint, as the monthly average for the two years for a family of five has been $3.30 and I have no other means of cooking. I have had no repair expense whatever.

Considered from the standpoint of service: During the two years I have been inconvenienced through lack of current but twice, and these occurrences from causes not under control of the local managers. I think the service has been exceptional. MRS. NEWELL.

A Real Boost for Electric Ranges

SOUTHERN PUBLIC UTILITIES COMPANY.

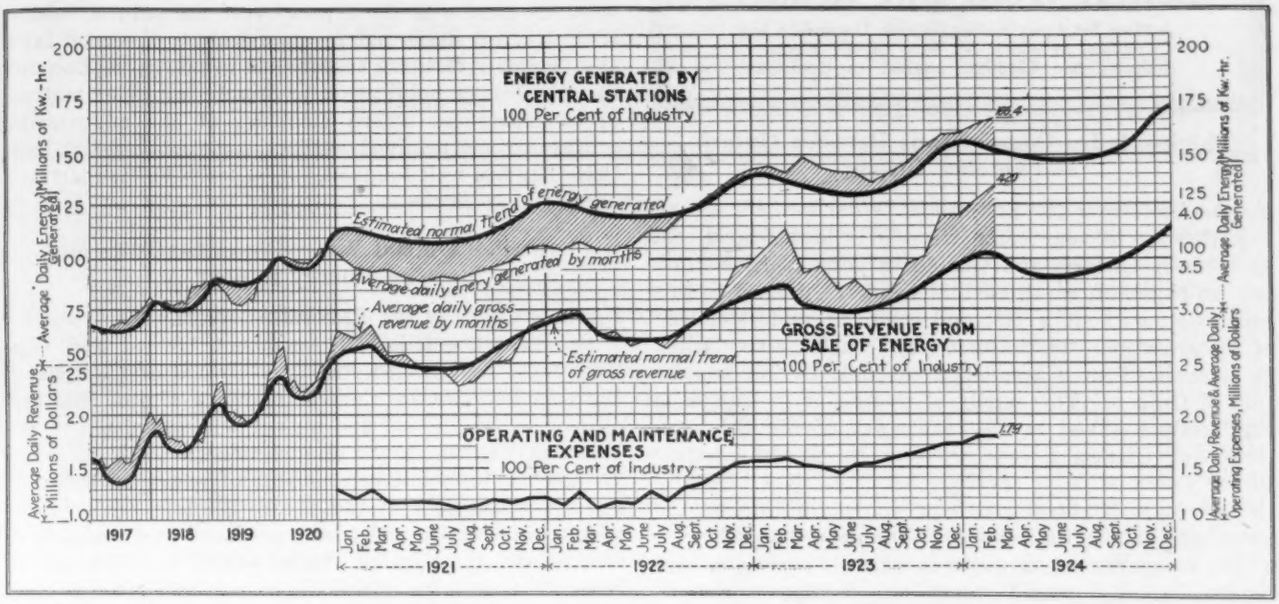
The electric range bought of you two years ago has been entirely satisfactory from the first day of installation. Haven't had to spend a cent for repairs. Would not be without it for many times its cost. No fires to kindle, no smoke to smell, just turn on the switch and at once it begins to generate clean, healthy, wholesome heat. I consider it the greatest convenience ever installed in a cook room, and too, the cost of operating is small when compared with the ease and comfort of cooking, and most especially in summer. Your electric range and service have been absolutely dependable. MRS. D. L. CARROLL.

Real Value Here

SOUTHERN PUBLIC UTILITIES COMPANY.

In reply to the above letter, so far as I can find out the stove so far has been entirely satisfactory. I don't see why more people don't use them, as they are safe and easy to operate. They are clean and easy to handle. If I could not get another one I would not take three times what it has cost me. W. H. ELLIOTT.

Record Operations Again Recorded During February


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
Estimated normal trend of energy generated
Average daily energy generated by months
Average daily gross revenue by months
Estimated normal trend of gross revenue
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920
1921 1922 1923 1924

RETURNS received by the ELECTRICAL WORLD from electric generating and distributing companies representing 74 per cent of the installed generator rating of the country indicate that during February the average daily generation and consumption of energy was the greatest in the history of the industry. The average daily gross revenue from sale of energy was also considerably above any previous figure.

The central stations of the country generated a total of 4,826,000,000 kw.-hr. in February, or a daily average of 166,400,000 kw.-hr. This is a gain of 15 per cent over February of last year. The first two months of the year indicate therefore that the growth of the industry during 1924 may be as great as that during 1923, which year showed a growth of 21.6 per cent over 1922. A study of the accompanying diagram indicates that the energy generated by central stations during February was about 9.5 per cent above what it would have been if the energy requirements of the industry had been normal.

A total of 932,000,000 kw.-hr. was used in intracompany business and line losses during February, leaving a total of 3,894,000,000 kw.-hr. sold to actual consumers. Of this amount sold, 16.2 per cent was consumed for lighting, 12.6 per cent by electric railways and 71.2 per cent for industrial power purposes. The returns indicate that a total of 557,000,000 kw.-hr. was sold within the industry for resale purposes during the month.

Although the total gross revenue from sale of energy only reached $121,700,000, or $5,100,000 under January, yet the average daily revenue was $4,200,000, a record figure and a gain of $110,000 over January.

TABLE I—CENTRAL-STATION OPERATIONS FOR THREE MONTHS

Mos.	Kw.-Hr. Generated Monthly*			Estimated Distribution of Energy Generated										Kw.-Hr. Purchased for Resale	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1923, Thousands	1922, Thousands	Per Cent Increase	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands
Dec...	4,950,000	4,425,000	11.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1924	1923													
Jan....	5,080,000	4,490,000	13.2	4,100,000	3,622,000	707,000	614,000	2,869,000	2,517,000	524,000	491,000	980,000	868,000	733,000	538,000
Feb...	4,826,000	4,200,000	15.0	3,894,000	3,390,000	632,000	548,000	2,772,000	2,399,000	490,000	443,000	932,000	810,000	557,000	470,000

* Exclusive of energy generated in Reclamation Service plants, purely electric railway plants and isolated or private plants.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS

Mos.	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1923, Thousands	1922, Thousands	Per Cent Increase	1923, Thousands	1922, Thousands	Per Cent Increase	1923	1922	1923	1922	1923	1922
Dec.....	$121,112	$107,645	12.5	$52,553	$48,748	7.8	48.1	49.4	26.0	28.1	43.8	47.8
	1924	1923		1924	1923		1924	1923	1924	1923	1924	1923
Jan.....	126,800	114,300	11.0	53,300	46,400	15.0	47.0	47.3	24.6	23.8	43.0	45.3
Feb.....	121,700	107,100	13.4	52,100	44,700	16.6	46.1	46.7	29.6	28.8	43.7	45.3

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Thinks Hydro Comparisons Between Ontario and Quebec Unfair

To the Editors of the ELECTRICAL WORLD:

Referring to your comparison of kilowatt-hour cost as between Ontario and Quebec in your April 5 number, on page 657, we think that you have jumped to this conclusion without a full and complete understanding of the situation. In the first place Quebec's population is centralized in a smaller area than is the population of Ontario. The supply of electricity in Quebec is practically confined to the two banks of the St. Lawrence and Ottawa Rivers, whereas the Hydro-Electric Power Commission is serving customers over virtually the whole of Ontario south of the main line of the Canadian Pacific Railroad to Winnipeg, Manitoba.

The comparison you quote is entirely unfair to the Hydro-Electric Power Commission. I suggest this as a manager of a municipally owned plant, one of the pioneers of long-distance transmission and entirely separate from the control of the Hydro-Electric Power Commission. The Hydro-Electric Power Commission is deserving of credit for the manner in which it is serving not only the rich but also the poor, not alone the urban center but also the rural center. More power to it!

It is admitted that the commission has made mistakes as all other bodies and companies have; but when the Gregory inquiry commission could make no stronger report against the Hydro-Electric than it did, I think it is a feather in the cap of Sir Adam Beck and his staff of engineers.

R. H. STARR,
Engineer.
Orillia Water, Light and Power Commission,
Orillia, Ontario.

Gregory Commission Engineers Defended Against Alleged Imputations

To the Editors of the ELECTRICAL WORLD:

The editorial in your publication of March 29 entitled "The Whitewashing of the Hydro-Electric Power Commission of Ontario" casts a very grave reflection on the reputable citizens and engineers composing or employed by what is known as the Gregory commission.

If I read the matter correctly, you imply that those responsible for the report of this commission were influenced by other considerations than the facts of the matter as the commission found them. One member of the commission was a past-president of the Engineering Institute of Canada; the chief engineer of the commission, unfortunately recently deceased, was at the time of his death chairman of the Engineering Institute of Canada, and there is no minority or other report to indicate that the engineers concerned did not concur in the findings of the commission as a whole. It seems to me, therefore, that by the implications of the editorial in question you have done yourself, the engineering profession as a whole, and Canadian engineers in particular, an exceedingly grave injustice. Engineers with whom I have discussed the matter concur in this view even to the extent of a suggestion that this action on your part merits the boycott of your publication by Canadian engineers at least.

All of this, of course, has nothing whatever to do with the merits of the report or of the subject matter with which it deals, but refers merely to the good faith and integrity of those responsible for it. It ill becomes an engineering publication to impute improper motives in circumstances where members of the engineering profession are involved without some evidence at least that they are well founded.

K. H. SMITH.
Halifax, Nova Scotia.

Canadian Official Water-Power Statistics and the Murray Report

To the Editors of the ELECTRICAL WORLD:

The report entitled "Government Owned and Controlled Compared with Privately Owned and Regulated Electric Utilities in Canada and the United States," written by Mr. Flood and myself and submitted to the National Electric Light Association in 1922, and concerning the economic relationship of power as produced under the auspices of the Hydro-Electric Power Commission of Ontario and power produced in a comparable district in the United States—that is, adjacent to Niagara Falls—has since that time called down upon our heads animadversions of assorted variety by Toronto and other Ontario papers committed to governmental ownership.

It was therefore with interest that I read your editorial on page 657 of the April 5 issue and noted that the Dominion Bureau of Statistics, in its official presentation of comparative figures pertaining to power production as in Quebec and Ontario, more than confirms the findings of our report. This is gratifying to me and strengthens the position I have taken in not replying to the many uncomplimentary remarks that have been made by the Hydro-Electric Power Commission's officials, newspapers and general proponents of governmentally produced power. I am not surprised, however, at these confirmations, as Mr. Flood and I were provided with official information in full detail, as the report indicated. To all inquiries and innuendo cast in my drection since the report by the above-mentioned proponents of governmental ownership I have remained silent, feeling that the report itself was the answer. This attitude I am now glad to have substantiated by your editorial.

W. S. MURRAY.
Murray & Flood, Engineers,
New York, N. Y.

Standard Wavemeters of the Bureau of Standards

TO SERVE as a standard of radio frequency the Bureau of Standards has two specially constructed wavemeters covering the frequencies in more general use from 18 kilocycles to 4,600 kilocycles per second (16,650 m. to 65 m.). Each consists of a variable air condenser of special design, four fixed mica condensers, a number of interchangeable inductors or coils and a resonance-indicating device. The majority of the inductors are wound with high-frequency cable in a single layer upon a skeleton frame of laminated phenolic insulating material, sometimes called bakelite.

The wavemeter is tuned to a source of radio-frequency currents by varying the air condenser and obtaining the maximum deflection of an indicating instrument which is connected to two turns of wire and loosely coupled to the inductor in the wavemeter circuit.

Central Station and Industrial Practice

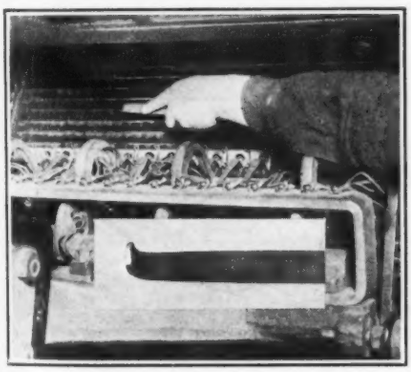
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Time-Saving Method for Seating Brushes

BY A. E. SCHIFFER
Foreman Armature Shop, New York Edison Company

THOSE who are familiar with the operation and maintenance of commutating machines, and more especially those engineers who have spent a part of their apprenticeship in the test department of some manufacturer, well know the particularly unpleasant drudgery of "grinding in" a set of direct-current brushes by hand.

Brushes installed with flat faces, as received from the manufacturer, require from four or five days to as many weeks, with the machine operating at reduced load, to seat themselves properly. The length of time required depends primarily on the composition of the brush and the condition of the commutator. It is usually undesirable as well as uneconomical to allow so much time for this operation, and it is impracticable to do the work by hand for the larger machines. The following method has, therefore, been employed by the electrical construction department of the New York Edison Company on machines having undercut commutators.



SLIGHT BURS MADE ON SEGMENTS TO SEAT NEW BRUSHES

A chamfering tool having one tooth with a cutting edge on each side is employed. The one illustrated herewith was made from an old file. The cutting tooth is drawn through a slot under sufficient pressure to form a slight bur or file tooth at the edges of the two adjacent commutator segments. This operation is repeated on from 10 to 15 per cent of the slots equally spaced around the commutator.

The machine is then operated for a sufficient length of time to produce complete contact over the entire surface of the brush. When a satisfactory surface is obtained the commutator is treated with a sandpaper block or fine commutator stone to remove the burs.

It has been found that a 4,000-kw., 25-cycle, eighteen-pole synchronous converter usually requires approximately two hours' time for the complete operation, including the cleaning of the apparatus.

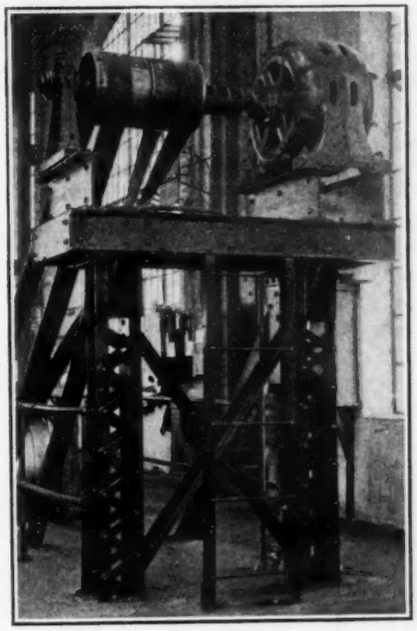
Preventing Powdered-Fuel Explosions

ONE of the problems connected with burning pulverized coal has been that of preventing explosions of the highly inflammable dust, particularly in the air-separation process. The Puget Sound Power & Light Company, one of the pioneers in the burning of powdered coal, has had two minor explosions in connection with one of its pulverizing mills. The last of these occurred in September of last year. No one was injured, but the mill, separator pipe and corrugated-iron wall of the building were damaged. An explosion occurred at this point the year previous.

The mill involved in this explosion works on the air-separation principle. The explosion occurred immediately after starting the fan which draws the pulverized coal from the mill. The other three mills operated by the company work on the screen principle with mechanical conveyors and as now installed have never given any trouble. The company therefore decided to standardize on screen mills, and the air separation mill has been removed. This decision was largely governed by the fact that a complete new mill was on hand available for installation. Undoubtedly it would have been possible to prevent a recurrence of the explosion by changes in operating methods or the rearrangement of the equipment.

Special Platform for Mounting Motor

A SOMEWHAT unusual motor mounting is shown in the accompanying illustration. The photograph was taken in an eastern machine shop handling heavy work in great volume. It was desired to keep the motor off the floor and well above the possibility of contact from passing workmen besides leaving ample space for the belt drive employed. A T-shaped platform of structural steel was formed of two columns and a horizontal I-beam frame, diagonal channel-iron braces being carried downward at the rear at an angle of about 60 deg. from the horizontal. One I-beam was then used as a base for the pulley-bearing pedestal shown at the left, and two I-beams at the right form the motor-base support. Pipe-frame guards safeguard passers-by from the double-belt drives shown.



T-FRAME OF STANDARD SHAPES CARRIES MOTOR AND PULLEYS CLEAR OF FLOOR

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Secondary Circuits

Secondary Racks.—In general, secondary circuits shall be carried on vertical racks. On ordinary straight lines racks shall be attached to the pole by one ⅝-in. through bolt at the top and one ¾-in. x 4-in. lag screw at the bottom. At angles, transformer poles, dead-end poles and points of unusual strain two ⅝-in. through bolts shall be used.

For three-wire secondary circuits, either single-phase or three-phase, a three-point rack shall be used with 4-in. vertical spacing between the conductors. For two-phase, four-wire circuits a four-point rack shall be used with 4-in. vertical spacing between the conductors. For single-phase two-wire circuits a three-point rack, with the middle position vacant, shall be used with 8-in. vertical spacing between conductors.

In general, power and lighting circuits shall be carried on separate racks. The lighting rack shall be installed on the pole above the power rack. Where two racks are installed one above the other on the same pole the insulator bolt for the lower rack shall be put in with the head toward the ground so that the rack may be disassembled in place. House brackets shall never be used on poles in place of standard pole racks.

Position of Grounded Wire. — The grounded wire of any secondary circuit shall always be carried on the top spool of secondary racks.

Position of Racks on Poles.—The top of the secondary rack shall normally be placed 7 ft. below the top of the first gain if the primary voltage is 2,300 or 4,000, and 5 ft. below the top of the first gain if it is 6,900 volts, except in cases where it must be placed higher to give proper clearance from other conductors. In no case shall the top of the rack be placed less than 5 ft. below the first gain. If the above clearance cannot be obtained on a pole which is in place, this pole shall be replaced with a higher pole.

Where space is available, secondary racks may be placed to follow the street grade if the appearance of the lead is thereby improved and the above minimum clearances are observed.

In alleys secondary racks shall be placed on that side of the pole lead on which there are the most houses. In general, on streets, secondary racks shall be placed on the street side of the poles. Where there are houses on only one side of the street for a considerable distance, the secondary rack shall be placed on that side.

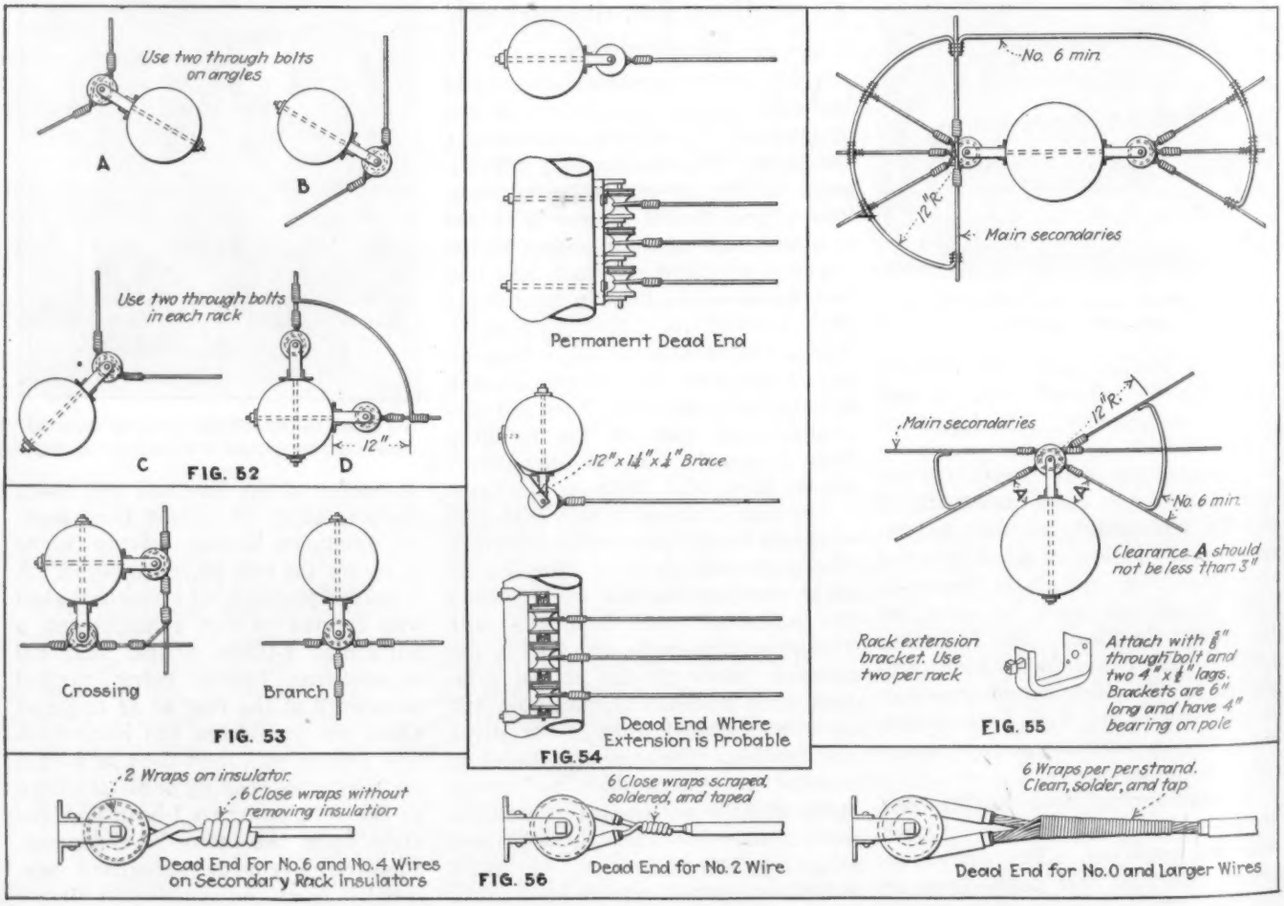
On any street or alley the secondaries shall be on the same side of the pole lead throughout its entire length. Racks shall not be transferred to the opposite side of the pole at angles (Fig. 52, where either A or B is permissible when turning an angle). It is not necessary to shift the rack to get the correction.

Secondary Dead-Ends. — Secondary circuits shall be dead-ended on racks as shown in Fig. 54. When no further secondary extension is probable, the racks shall be placed on the face (or back) of the pole instead of the side. When the secondary circuit may be extended at a later date, the rack shall be placed on the side of the pole and two galvanized-iron braces, 12 in. x 1½ in. x ¼ in., twisted as shown in Fig. 54, shall be used to take up the unbalanced strain.

Wires shall be dead-ended in each direction at right-angle corners, as shown in Fig. 52, unless a circuit is dead-ended not over two spans from the corner in both directions, in which case a single rack set to split the angle shall be used. Secondary dead-ends shall be made up as shown in Fig. 56.

Position of Wires on Racks.—On ordinary straight-line construction all wires shall be tied to the spools on the side away from the pole. At transformer poles the wires shall be tied to the spools on the side toward the pole. At angle poles wires shall be tied to spools on the side away from strain.

Service Connections.—Service wires shall be dead-ended short on the rack


Use two through bolts on angles
A
B
Use two through bolts in each rack
C
D
12"
FIG. 52
Crossing
Branch
FIG. 53
Permanent Dead End
12" x 1¼" x ¼" Brace
Dead End Where Extension is Probable
FIG. 54
No. 6 min.
12" R.
Main secondaries
Main secondaries
12" R.
No. 6 min.
Clearance A should not be less than 3"
Rack extension bracket. Use two per rack
Attach with ⅝" through bolt and two 4" x ⅝" lags. Brackets are 6" long and have 4" bearing on pole
FIG. 55
2 Wraps on insulator
6 Close wraps without removing insulation
Dead End For No. 6 and No. 4 Wires on Secondary Rack Insulators
6 Close wraps scraped, soldered, and taped
Dead End for No. 2 Wire
FIG. 56
6 Wraps per per strand. Clean, solder, and tap
Dead End for No. 0 and Larger Wires

FIGS. 52 TO 56—TYPICAL CONSTRUCTION FOR SECONDARY LINES OF DISTRIBUTION SYSTEMS

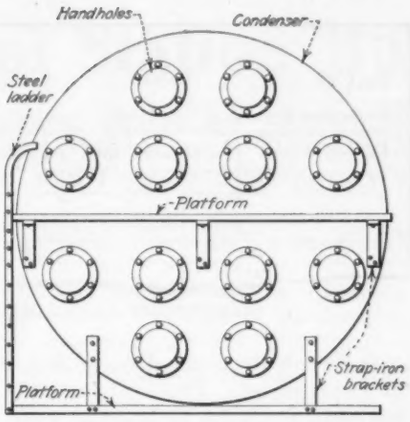
insulators and connected to the secondary mains by means of jumpers, as shown in Fig. 55. Wires shall not be run back along themselves to make the jumpers from the same wire as the service. Jumpers shall not be duplicated, new services being connected to existing jumpers by a wrapped and soldered joint as shown in Fig. 55.

Secondary Crossings and Branches.— Where secondary mains cross each other connection shall be made by means of jumpers, as shown in Fig. 53. Branch secondary circuits shall be dead-ended on the line racks and connected to the secondary mains by means of jumpers, as shown in Fig. 53.

Clearances. — Secondary wires shall clear the surface of poles and cross-arms by 3 in.; they should clear all wires not attached to the same pole by 2 ft. and should clear all telephone or signal circuits by 4 ft. Any two secondary wires of the same circuit must clear each other by 4 in. Secondary or service wires shall clear all primary or street light wires on the same pole by at least 6 in. If the above clearances cannot be obtained with the secondary line rack, the second rack shall be installed. In rare cases it may be necessary to use extension brackets for mounting the first secondary rack, as shown in Fig. 55.

Permanent Platforms for Condenser Inspection

WHEN turbine condensers must be inspected, cleaned or repaired, it is usually necessary to erect a temporary scaffold for the men to stand on. Construction of the scaffold consumes time, the construction may not always be the safest in the world, and the lumber quickly finds its way to the rubbish pile. Since the Memphis Power & Light Company makes it a practice to open its condensers once a month, the foregoing objections to a temporary scaffold would arise twelve times a year. Consequently permanent platforms have been mounted on strap-iron brackets attached to the ends of the condensers. One

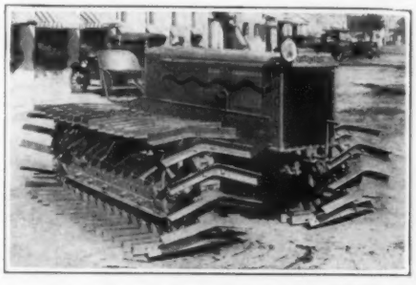


PERMANENT PLATFORMS FOR REPAIRING AND CLEANING CONDENSERS

platform is placed across the diameter of the condenser and one about tangent to the lower edge of the circumference, thus avoiding obstruction of the handholes.

Tractor for Patrolling Transmission Line

OWING to the difficulty of patrolling its transmission line with men or horses in the Owens River Valley, where the snows are very deep in the winter, the Southern Sierras Power Company of Riverside, Cal., had the special tractor shown in the accompanying illustration built. This tractor proved very successful for winter work. A cab is mounted on the machine to protect the patrolman or operator from the weather.



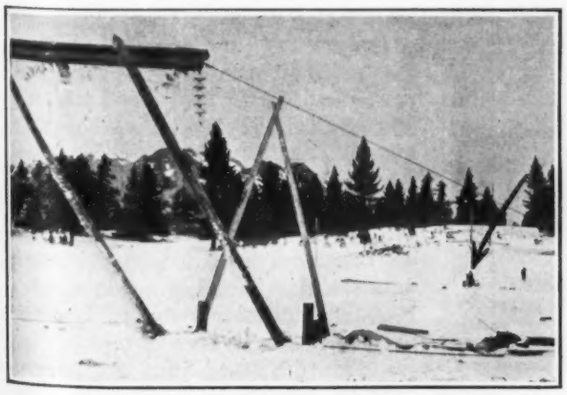
TRACTOR FOR USE IN SNOW IN PATROLLING POWER LINES

Although the tractor shown has angle-iron treads, it was found advisable to equip it with plate treads to give better bearing in the snow.

The first tractor purchased had to be taken in over the snow for a great many miles by its own power. The company was fortunate in having this tractor available during the spring of 1923, as it proved invaluable in reconstructing a section of transmission line blown down by a very high wind. The tractor being used in the erection of one of the two-pole wooden structures is also shown (tractor indicated by arrow). All of this reconstruction work had to be done in snow.

Ordinarily in patrolling certain sections of this transmission line a man has to use snowshoes or skis, assuming that the trouble is apparently of a minor kind such as an accident to a telephone line, etc. When the power line goes down, however, it means heavy construction, and if material is to be hauled to the spot, the use of horses is almost out of the question unless they are equipped with snowshoes, as some of the horses in this section have been in past years. This requires special training of the animals and cannot be relied upon as a satisfactory method of getting material to the job. The only alternatives left open are haulage by workmen on snowshoes and tractor haulage.

It is, therefore, not so much a question of cost as it is a matter of getting the job done. Use of the tractor may mean the repair of a line in reasonable time, whereas without it the delay may be serious unless material happens to be within the immediate vicinity of the trouble.



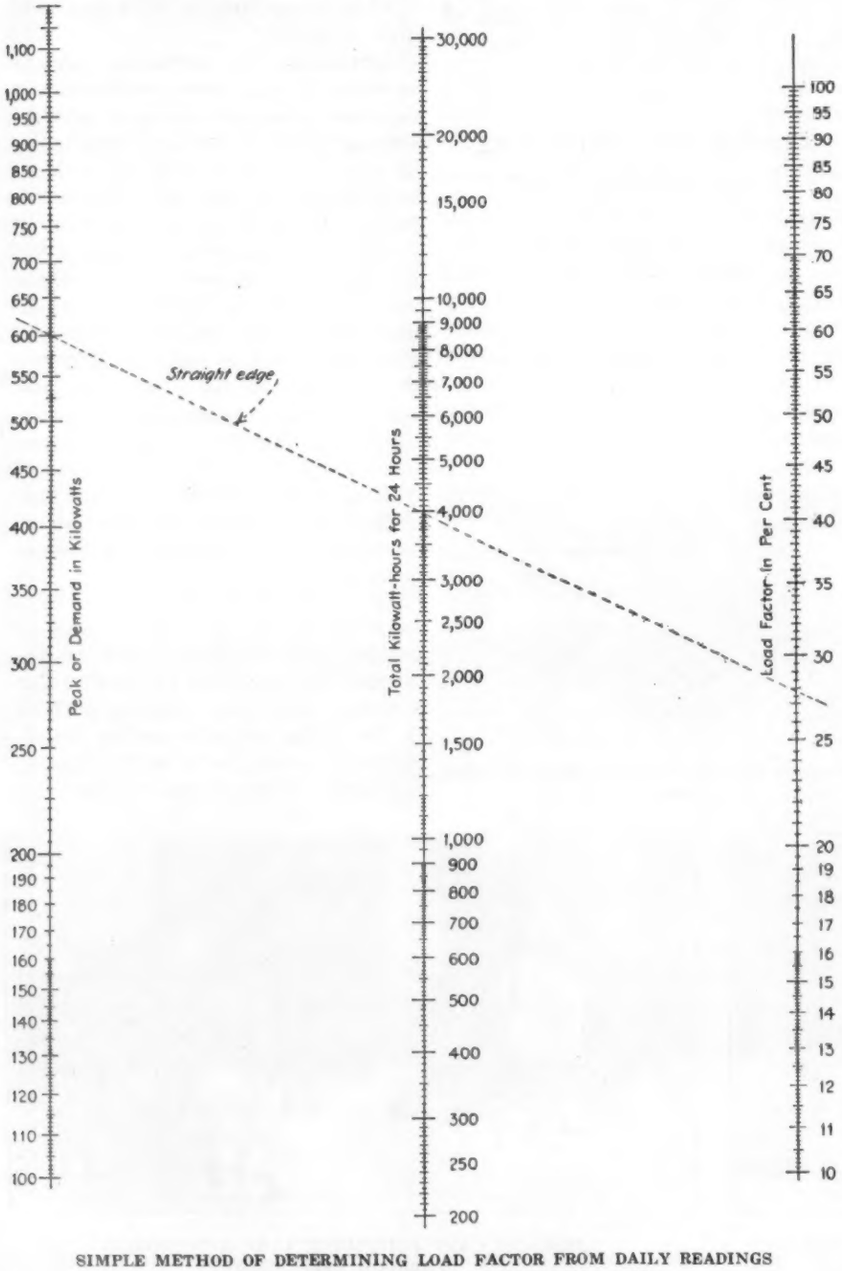
ERECTING AN OVERTURNED TOWER BY USE OF A TRACTOR

HAULING CAMP EQUIPMENT (AND AUTOMOBILE) THROUGH DEEP SNOW

Computing Load Factors Graphically

BY J. H. PHILLIPS
Oklahoma Gas & Electric Company,
Oklahoma City, Okla.

A CHART for graphically determining the load factor of a plant or system to within an accuracy of one-half of 1 per cent is shown in the accompanying illustration. This should be useful to station operators in computing the load factor or in checking such a computation. It is read by placing a straight edge across the chart intersecting the middle scale at the value of gross kilowatt-hours generated for a day, or the average of a given period of days, and intersecting the left scale at the kilowatt demand or peak for the same period. The load factor is then read from the right-hand scale. With larger plants the kilowatt-hour and demand scales must be multiplied by 10, 100, or 1,000 to secure the proper result.



SIMPLE METHOD OF DETERMINING LOAD FACTOR FROM DAILY READINGS OF PEAK LOAD AND TOTAL ENERGY GENERATED

Block No..... Section ..... Location.....

Boundaries N.....S.....E.....W.....

Pole	Length	Set	Inspec.	Condition	Replac.	Inspec.	Condition	Replac.	Inspec.	Condition	Replac.	REMARKS
A												
B												
C												
D												

TRANSFORMER RECORD CARD USED BY ROANOKE COMPANY

Keeping Transformer and Pole Records

THE Roanoke Railway & Electric Company has utilized a map and card system to maintain a perpetual inventory of its lines, poles and transformers. The general principle followed is to use a master map divided into sections. The sections are reproduced on a scale of 200 ft. to the inch on smaller maps, which are supplemented by card files.

For pole records a master map of the city is divided into districts and each block receives a number. The large-scale section maps are then used, and on the numbered blocks of each section all poles are exactly located and are lettered A, B, C, etc., for each block. These letters are stenciled on the poles in their location and are recorded on a card record as illustrated. If there are more than twenty-six poles on a block, double letters are used, such as AA, BB, etc. On the card record the life history of the pole is recorded and other data as indicated.

For transformers only a master map is employed, and on this thumb tacks with stamped numbers are used to indicate where transformers are located. A card bearing location identification, transformer number, rating and connected load is kept in a file, and with each transformer card are filed data cards for each installation served.

For wires and cables another master map is used showing all power and light circuits and the size and length of each wire. A separate map is used for the street-lighting circuits.

By means of a record system of this type a good check is kept on the distribution system and valuable data are maintained at headquarters. It is felt that more elaborate systems are not warranted on properties of the size discussed, and experience with the system has proved it to be adequate and very useful to the utility.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Building Industrial Electric Heating Load

By R. C. GRIFFIN
Power Sales Engineer Pacific Gas & Electric Company, San Francisco

THE use of electric power for motor drive has become so generally recognized as the most economical that the central station can turn its attention to the investigation and development of other uses for electricity. One of the major sales activities of the Pacific Gas & Electric Company is to develop load on existing distribution lines, and to do this a creative sales department has been organized. In the production of many articles, the labor cost is of considerable importance, so that wherever the use of electricity can eliminate a certain amount of labor, shorten the cycle of operations or in some way reduce the actual cost of production it finds a ready application.

In order to determine just what opportunity there existed for using electricity in industry for various heating processes, this company has put into the field power salesmen trained to find such applications. These salesmen call upon the manager or superintendent of a plant, inquire if the company's service is satisfactory and try to ascertain if full use is being made of all possible electric applications. The salesman makes inquiry in regard to the processes in use and asks if electric heating has ever been tried for the company's various heating requirements.

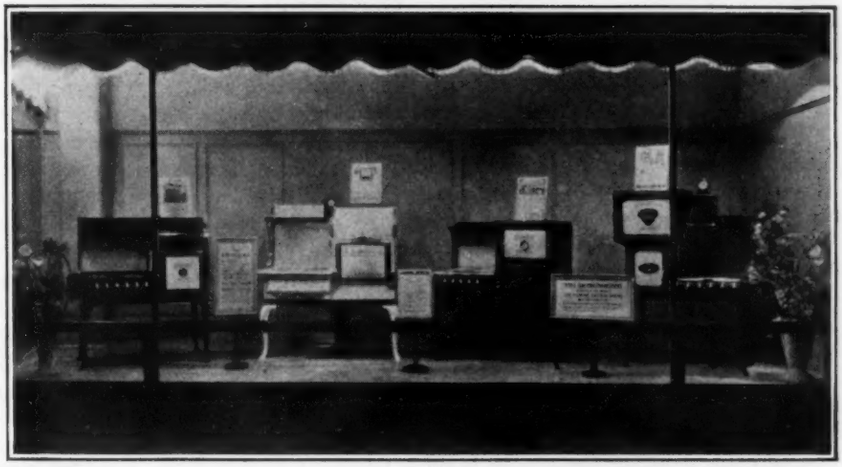
By gaining the confidence of the factory manager, the salesman then obtains permission to make a thorough inspection of the entire plant to see just what processes can be operated electrically. In making the survey the industries are grouped into related processes, so that the salesman can give close attention and study to the characteristics of one particular group at a time. It may be that the gear-making plants are on the list for investigation. When the creative power salesman gains admittance to the plant he notices a heat-treating furnace for treating the gears. The furnace, he observes, is operated by oil and in the heat-treating process a considerable amount of scale or oxidation occurs, so that a large sand-blast outfit is needed to sand-blast the gears after heat treatment. Blasting is necessary to make the gears acceptable by the trade.

This circumstance is carefully noted by the salesman. He then reports to the factory manager that he has made an inspection of his plant, has noticed an oil-fired heat-treating furnace and would like to suggest that the method of electric heat-treating is far superior to his present method of operating. The factory manager may listen to the suggestion, but nearly explodes before the salesman has finished, because of the common conception that electricity costs more for heating purposes than oil. He does not know of the advantages which well warrant the price paid for a far superior method. In the case of the heat-treating furnace he is shown that the temperature control is exact and uniform and that his product can be duplicated time after time. The remarkable precision with which the electric heating furnace can be operated is thus made clear to him. A further item of interest to the factory man is the fact that the sand-blast machine is no longer needed, because the scaling is almost negligible, so that the gears are ready for the market without this extra process.

This method of procedure could be followed by the power salesman in many instances. The seed or germ is sown by him, as he has only service and an idea to sell. The factory manager sees the possibility of increasing his production and improving his product and is soon ready to think of particular equipment. When this point is reached the prospective customer's name is called to the attention of a manufacturer of the desired equipment. The sales agent of the manufacturer then calls and offers the particular type of equipment best suited for the particular application of industrial electric heating under discussion.

Very often the procedure as re-

Central Station Co-operates in Boston Cooking School



DURING the week of the highly successful electric cooking school in Boston, which was reported in the ELECTRICAL WORLD last week, the Edison Electric Illuminating Company of Boston utilized the display windows of its main office for a co-operative exhibit of the electric ranges of four manufacturers. C. E. Greenwood, superintendent of the company's appliance department, who was instrumental in organizing the manufacturers' co-operation, stated that keen interest in the cooking school extended well throughout New England and considerably beyond the territory directly served by the lines of the Boston Edison Company.

cited above is just reversed. The manufacturer's agent has sold the idea, and then the factory manager wants to get the opinion of the power man as to the cost of operation of a particular piece of apparatus at the prevailing rates. Other features incident to the new method of operation may arise so that the power salesman is then in a position to clinch the sale. It is most desirable that the two factors in the development of industrial electric heating load, the central station and the manufacturer, work in close harmony with each other in order to obtain the best results.

Letting Window Space to Electrical Dealers

WHILE the Memphis Power & Light Company is planning to carry on electrical merchandising, it has not yet done so. Since it took control of the Memphis system a year ago, however, it has not been unmindful of ways in which it could help stimulate electrical business. One way has been to allow the electrical dealers in Memphis to use the utility company's show windows in turn. Each dealer has this privilege without charge for a period of two weeks, displaying any electrical equipment which he desires and announcing the location of his shop. The company reserved the right to approve the display, feeling that it could offer important suggestions as to how the windows could be dressed and display posters used most effectively.

Between dealers' turns the utility company has used the windows for its own purposes. As a result of this practice without actually merchandising, the company has displayed to consumers who visit its offices electrical equipment which could be used to the mutual advantage of the customer, the utility and the retailer. The utility thus developed revenue-producing electrical business without any investment except the show-window space, besides gaining the good will of the electrical dealers, many of whom became much more widely known than before. Because of this co-operative practice the utility is on the most friendly terms with local dealers, who, in turn, have influenced the public in a similar way. To maintain these friendly relations when the company starts merchandising the business will be conducted on a profit-producing basis.

How 9,018 Kitchen Lighting Units Were Sold in Thirty Days

In Some Communities a 47.5 per Cent Saturation Was Reached—All Central-Station Employees Participated in the Campaign

A KITCHEN - LIGHTING unit campaign resulting in the sale of nearly $60,000 in electrical merchandise, and which will earn $75,000 in gross revenue from energy consumed during the next eleven months, was staged by the Public Service Company of Colorado in Denver and nearby towns early this year. During the thirty-day campaign 9,018 lighting units were sold. A saturation in various communities ranging from 47.5 per cent to 8 per cent was reached. In some towns the general employees sold more units than the representatives of the commercial department. Additional sales of 600 convenience outlets were made, and an immediate stimulation of interest in better home lighting resulted.

The units were sold installed for $6, payable at the rate of 50 cents a month with the lighting bill, and thirty days' free trial was permitted. No extra charge was made where a pull chain switch was required. When the commercial representative surveyed the prospective customer's kitchen the type of holder required was noted and the customer was not confused with talk about different types of holders and switches. In Denver and the larger cities of the western division the assistance of local contractors was enlisted in hanging the units, while in the smaller towns the company made the installations with its own employees.

Holders for the units were manufactured in Denver according to specifications drawn up by the company's production manager and fixture man. Three local fixture and spinning works produced the holders on schedule, and the glassware was not attached until the hanging of the unit in the home. The holders were designed for the use of 150-watt daylight lamps and included a reflector baffle plate. They were finished in white enamel and were so designed that a canopy switch could be included when necessary. White enamel was also used on the units.

SALES OF KITCHEN UNITS IN SMALLER CITIES

Town	Number of Domestic Customers	Number of Units Sold	Per Cent of Domestic Customers Sold to
Lafayette	1,018	483	47.5
Fort Collins	2,532	1,141	45.1
Boulder	3,192	864	27.0
Loveland	1,613	384	23.8
Cheyenne	3,194	572	17.9
Windsor	427	72	16.8
Total	11,976	3,516	29.3

Advertising Campaign

Newspaper advertising was used in all the towns on the system, but the initial advertising appeared in the Denver papers a week in advance of the opening, with a statement that the campaign would include all communities served by the company. Broadsides were mailed to all customers according to a schedule which would insure their delivery not more than a day or two in advance of a call by a representative.

Stickers with perforated return postal cards were also attached to the monthly service bill of each customer, and a splended response was noted from this activity, according to George W. Bixler, publicity director of the company in Denver. A large number of customers asked through this medium for a trial installation of the unit before the representative had time to make a call on them. At each of the company's offices window displays were arranged to show a contrast between a modern and an improperly lighted kitchen. Flashers were employed in several cases to facilitate the comparison.

Several "booster" meetings were held just prior to the opening of the campaign. At these meetings the general features of the campaign were outlined, announcements made of campaign and special prizes and individual sales quotas established, with inspirational talks by company officials and representatives of the glassware and lamp company whose products were used in the campaign.

In northern Colorado the interest developed by the employees became so keen as a result of the encouragement given by C. A. Semrad, assistant general manager of the company, that permission was given to the entire force to sell units. Meter readers, storekeepers, members of line gangs, and even employees of the gas department, joined in the

campaign, and the total number of sales made compared favorably with those in the recent customer-ownership campaign conducted in all of the cities and towns served by the Public Service Company of Colorado.

Of the employees at Fort Collins, Col., there was not one who did not sell at least one unit. The man in charge of arc lamps in that city sold 218 units after regular working hours. A meter reader sold sixty-five, while the storekeeper of the company placed fifty-four.

RESULTS OF CAMPAIGN

Interesting conclusions may be drawn from the comparative sales of units in the various communities served by the company. Most striking is the fact that in the smaller towns a larger percentage of domestic customers became purchasers than in the bigger cities. Although 5,502 units were sold in Denver alone, this represents only 8 per cent of the total customers, while in Lafayette, Col., with a large population of foreigners and a poorer class of people, 47.5 per cent of the customers signed up for kitchen units.

Figures on total sales made in the various offices of the western division of the company are shown in the accompanying tabulation.

According to Thomas F. Kennedy, general commercial manager of the Doherty companies, this campaign was the most successful ever staged by the commercial department of any of its subsidiaries, and the results obtained in the towns on the western division of the company have established a new record, representing the largest percentage of sales of kitchen units per domestic customer yet attained by any new-business department of the company. The officials of the company are firmly convinced that the lighting activity has stimulated interest in all phases of improved home lighting and brought home the desirability of additional convenience outlets.

Window Displays to Educate the Public

THE educational value of window displays in enabling the public to visualize some of the physical aspects of the light and power business has been recognized by the Southern California Edison Company, and for some time it has been using displays similar to those which are shown in the accompanying photographs.

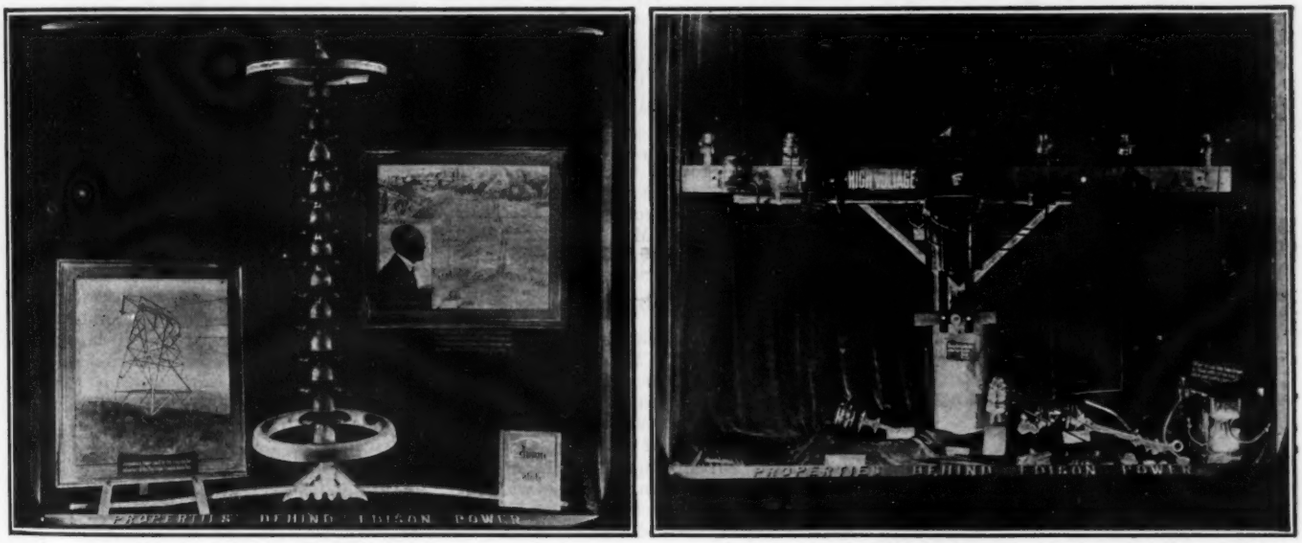
It has been gratifying to find that during the busy part of the day there are always from three to six persons studying the window, which is on one of the busy streets of Los Angeles. The windows are well illuminated at night, and prior to the series of technical displays colored enlargements of some of the company's hydro-electric power plants in the High Sierras were exhibited. Such displays have been found to assist materially in enlightening the public as to the company's physical property and they have also helped in the sale of Edison stock.

What Other Companies Are Doing

Providence, R. I.—A net sale of between 4,800 and 5,000 kitchen-lighting units has been attained by the Narragansett Electric Lighting Company in a two months' campaign for the installation of 100-watt equipment. The aid of an outside sales organization was utilized on the strength of preliminary newspaper advertising prepared by the central-station company.

Spokane, Wash.—The Washington Water Power Company recently illustrated by means of three floats how electricity has increased home comfort. The first float represented an old-fashioned kitchen with its coal stove, a woman bending over the washtub and a boy studying his lessons by a kerosene lamp. The second float was a painting of the company's water-power plant, illuminated by spotlights and concealed footlights. The third float showed a modern kitchen with an electric range and other electrical devices.

Buffalo, N. Y.—The Buffalo General Electric Company will build a four-story addition costing $200,000 to its present headquarters building, the well known "Electric Tower." When the original building was put up, twelve years ago, it was the expectation that it would take care of all office and display needs for at least twenty years, but the company's business has grown so greatly that on some days as many as 15,000 customers visit the building.



EDUCATIONAL WINDOW DISPLAYS USED BY SOUTHERN CALIFORNIA EDISON

Left—One of the suspension insulator strings used in the 270-mile, 220,000-volt transmission line from the Big Creek plants. The circular rings at the upper and lower ends of the insulator string are the aluminum corona shields used to distribute more equally the electrostatic stresses along the insulator string.

Right—Typical distribution-pole top equipment, showing a small transformer and the fuses as they are installed to supply lighting service.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Power Supply in South Wales.—An interesting example of bulk supply of electricity by overhead lines at 33,000 volts is furnished by the installation recently put into operation between Gorseinon and Pontardulais, South Wales. A very complete and clear description is given of the two substations and transmission lines.—*Engineering*, Feb. 29 and March 7, 1924.

Importance of Boiler-Plant Test—H. SEYMOUR.—A brief article telling how to conduct a simple boiler test in power plants. The measuring instruments necessary, the form in which to take down necessary readings and general instructions are given.—*Electrician (England)*, March 21, 1924.

Power-Plant Design and Operating Cost.—A comparison of costs which enter into power-plant design and maintenance when various types of prime movers are used. Investment and operating costs of a 1,500-kw. central-station condensing plant with superheater are tabulated in detail. Figures are given for seven types of prime movers—uniflow engine, simple four-valve engine, compound four-valve engine, simple Corliss engine plant, compound Corliss engine and Diesel engine.—*Power Plant Engineering*, April 1, 1924.

Generation, Control, Switching and Protection

Periodic Power-Plant Inspection.—Many of the instructions issued by the Federal Light & Traction Company to the managers of its subsidiaries covering the inspection of power-station apparatus are given. They include instructions for inspecting turbo-generator units, condensers, boilers, stokers and furnaces, feed-water heaters, auxiliaries, switchboard instruments, etc.—*Power*, March 11, 1924.

Multiple-Radial System of Cooling Large Turbo Generators.—DONALD BRATT.—The paper discusses the theoretical basis of a special turbo-generator ventilation system in which the cooling air divides into several branches and passes through the stator core radially in and out.—*Journal of A. I. E. E.*, March, 1924.

Control of Electrostatic Field.—W. KEHSE.—Theoretical considerations have led the author to a design principle which may prove valuable for the construction of high-voltage bushings and the major insulation on transformers. Introducing at the points of greatest density of the electric field a number of metallic rings insulated from one another with a dielectric of a thickness graded in reverse proportion to the density of the field, the author divides the customary striking distance into a large number of small gaps, basing his theory upon the fact that the specific rigidity of insulating mediums is larger for short distances. For a distance of 4 in. and more a stress of 33 kv. per inch under oil cannot be exceeded. Dividing the gap into a large number of small gaps, a stress of 100 kv. per inch may be used safely. On high-voltage transformers it is customary to keep the first and last coil of the high-voltage stack the full striking distance away from the iron core. This is necessary because a very dense electric field is abruptly broken at these points. If, however, between the ends of the stack and the yokes are introduced a large number of metallic rings of a thickness gradually decreasing toward the iron, and their interstices are filled out with annular insulating spacers of gradually increasing thickness, the electrostatic field will be found to decrease slowly from its full value to zero and may thus be fully controlled.—*Elektrotechnische Zeitschrift*, March 13, 1924.

Transmission, Substations and Distribution

Interconnection, Superpower and Electrification.—S. Q. HAYES.—A critical survey of the power generating sources in the Eastern half of the United States. Interconnection maps of the various sections of this part of the country are reproduced and the whole subject of interconnection between the various companies is discussed. This article is the second section of a comprehensive survey on this subject which is to cover nearly the entire globe.—*Electric Journal*, March, 1924.

Submarine Across the Mississippi.—L. D. MOORE.—At Dupo, Ill., the Missouri Pacific Railway system has abandoned a small generating station supplying its freight terminal at this point, buying instead power from the Union Electric Light & Power Company of St. Louis. This necessitated the installation of a cable across the Mississippi River. The transmission voltage used is 13,200, and the rating is ample to carry 450 kva. A detailed description is given of the laying of the cable and of the outdoor substation installed at the railway yard.—*Railway Electrical Engineer*, March, 1924.

Units, Measurements and Instruments

Electrostatic Voltmeter.—A. IMHOF.—For direct measurements of very high voltages the author recommends an ordinary static voltmeter of the quadrant type connected to a specially arranged air condenser. Coaxial to a vertical metallic rod, which carries the high potential, is placed at the proper distance a small metallic collar. A second cylindrically formed metal piece surrounds both the rod and the collar. These two concentric cylinders are fully insulated from each other and from ground. The static voltmeter is attached to the outer cylinder, and its moving parts are connected to the inner and outer cylinder respectively. The instrument then measures the potential difference between the two concentric metal armatures. As this varies in proportion to the potential on the central rod, the scale of the voltmeter may be calibrated directly in values of the high voltage. As it is not difficult to provide the required insulation, a very high field density may be chosen, which gives the moving element of the voltmeter an unusually high torque. It is claimed that this instrument fulfills all theoretical requirements to the highest degree.—*Bulletin de l'Association Suisse des Electriciens*, February, 1924.

Dielectric Losses of Cable Compounds.—H. W. BIRNBAUM.—This paper gives the results of a large number of dielectric test measurements on various cable compounds made in the laboratories of a cable company. As it was desired to study the influence of temperature upon the losses, a special testing condenser was made, which was placed in a water bath and insulated for 50 kv. against ground. The measurements were made with a high-tension bridge and commercial 50-cycle alternating current up to 20 kv. About fifteen different materials, some of American origin, were investigated, showing greatly varying characteristics. With none of these subtances was a critical voltage observed as long as they contained no trace of air. If air is introduced, a certain ionization voltage can be found for every compound, and the otherwise steady character of the dielectric loss curve shows a decided variation. If a solid material, like paper, is used as a carrier of the compound and is completely saturated with the oil, its influence upon the magnitude of the loss angle is asserted to be of only subordinate importance.—*Elektrotechnische Zeitschrift*, March 20, 1924.

Illumination

Application of Scientific Illumination in Practice.—G. HERBERT and R. A. IVES.—The authors in dealing with the problem of obtaining popular support for illuminating engineering mention some of the experiences that makers of lamps and lighting appliances have met in approaching the users. There can be no question that there is much more importance attached to good lighting than in the past. At present one of the chief themes is the compilation of data illustrating the relation of inadequate lighting to accident and the advantages of good illumination in removing handicaps to efficient production.—*Illuminating Engineer*, Vol. XVI, No. 10-12.

Visibility of Radiant Energy.—K. S. GIBSON and E. P. T. TYNDALL.—A new determination of the visibility of radiant energy has been made by the Bureau of Standards in co-operation

with the Nela Research Laboratories. The step-by-step method was used, an equality-of-brightness method with little or no hue difference in the two parts of the photometric field. The apparatus and method are briefly described. Energy values were based upon radiometric and spectrophotometric measurements made at the bureau, checked by an independent color temperature measurement at the Nela Research laboratories. A revision of the visibility values adopted by the I. E. S. is proposed which results in better agreement with the average experimental data and still gives the same wave-length center of gravity for light of a color temperature of 2077 deg. K. as is given by Ives' physical photometer solution.—*Transactions of I. E. S.*, February, 1924.

Motors and Control

Single-Phase Variable-Speed Motors.—N. P. PEREZ.—The single-phase shunt-type commutator motor, in addition to its ability to start against heavy loads and to work at unity power factor on load and with a leading current at fractional loads, lends itself to easy and economical speed control without impairing its shunt characteristics along all its speed range. Consequently this feature recommends the motor in all cases where a modern speed range is required and no great variation in speed is permissible with varying loads, as when driving printing presses, machine tools, fans, etc. The author, in a theoretical discussion, considers the shunt method of speed control.—*Electrical Review* (*London*), March 7, 1924.

Economical Selection of Pumping Equipment.—F. A. MAZZUR.—This question is considered from the standpoint of station economy, with particular reference to a water pumping plant. Initial installations and operating costs are compared for steam, electrical and oil-engine-driven units. All figures are based on a capacity of 3,000,000 gal. per day.—*Canadian Engineer*, March 11, 1924.

Layout of Group and Individual Drives.—R. W. DRAKE.—The third and final article on this subject, which deals particularly with suggestions and layout of installations of individual and group drives, together with special features determining the layout of fan drives and the results of tests on line-shaft friction losses.—*Industrial Engineer*, April, 1924.

Heat Applications and Material Handling

Charging Facilities for Electric Vehicles.—J. P. KEMP.—The author describes a five-wire balancer for charging vehicle batteries that can be adapted for any number up to twenty-four vehicles. This balancer takes its supply from a 440-volt direct-current source and transforms it into four separate supplies of 110 volts each. Dealing with one vehicle only, the over-all efficiency of the balancer is about 75 per cent. When the second, third and fourth vehicles are added to the remaining legs, the efficiency increases to 85 per cent, 90 per cent and 92 per cent respectively. When twenty-four vehicles are being charged simultaneously and all reasonably balanced, the over-all efficiency would approximate 98 per cent.—*Electric Vehicle*, March, 1924.

Electrophysics, Electrochemistry and Batteries

Rare Gas-Filled Tubes as Rectifiers.—K. LORENZ.—The operation of telegraph and telephone service has been maintained in the past with direct current derived from batteries, storage batteries or small motor-generators. The early attempts to utilize the rectifying characteristics of tubes filled with rare gas failed because the resulting direct current had a sufficient amount of ripples to cause a strongly audible disturbance in a telephone. Experimental research work of the author has led to circuits containing two tubes, ordinary telephone condensers of 2 mf. and choke coils, which give in derivation of a 110-volt or 220-volt alternating-current supply a perfectly uniform direct current which may be used readily for the operation of telegraphs or telephones instead of batteries. With proper adjustment of the auxiliaries the resulting current may supplant batteries even for closed-circuit systems as these tubes consume a minimum amount of energy.—*Elektrotechnik und Maschinenbau*, March 16, 1924.

Progress in Electrolytic Iron.—D. BELCHER.—The author sums up the progress made in the electrodeposition of iron in the last seventy-five years. A brief description of the two plants now in commercial operation is given, and a short account of the development work on the Milford process for the hydrometallurgy of iron ores is added.—*Paper presented before the American Electrochemical Society, Philadelphia*, April 24-26, 1924.

Traction

Regenerative Control for Traction Motors.—R. D. ARCHIBALD.—The present position of regenerative control for railway cars is discussed. A description is then given of a method of self-exciting the field of a direct-current series motor with a low-voltage rectified current transformed from alternating-current tappings in the armature. Under these conditions the motor behaves like a shunt machine, and characteristics are shown when it is acting regeneratively and also when it is used as a generator and motor. Calculations are given for finding the conditions of sparkless commutation of the rectifier, and tests are included which corroborate the calculations. In conclusion, some points are discussed with regard to the practical application of the device.—*Journal of Institution of Electrical Engineers* (*England*), March, 1924.

Single-Phase Electric Locomotives.—A description is given of twenty locomotives built by a Swiss manufacturer to be used by the Swiss railways. Six of the locomotives are for the St. Gothard line and are of the type 1-B-1-B-1. The remaining fourteen are of the type 1-C-1 and are for express service for the level portion of the road. The first type, operating at 15,000 volts and 16⅔ cycles, are designed to haul 300-ton trains, excluding the weight of the locomotive, on a gradient of 2.6 per cent, at a speed of 50 km. per hour. The second type of locomotive is capable of hauling a train of 480 tons, including the weight of the locomotive, on a gradient of 10 per cent at a speed of 65 km. per hour, while on a 2 per cent gradient a speed of 90 km. per hour has been obtained. A very detailed description is given of the mechanical and electrical construction of each type.—*Engineer* (*England*), March 21, 1924.

Telegraphy, Telephony, Radio and Signals

Operating Features of Electric Interlocking.—Electric interlocking may be installed for plants of any size and is used quite generally for interlocking where the number of switches and signals is too great for the satisfactory use of electromechanical machines. Both switches and signals are operated by means of electric motors controlled from the central point or tower. Electric plants have been installed where either direct or alternating current is supplied. A recent application of the electrical operation of switches has been to handle an outlying switch at any distance from the station. A simple circuit controlled with indicators known as the table lever machine gives the station operator an ability to operate the outlying switch electrically and to control signals governing train movement over the switch.—*Railway Review*, March 15, 1924.

Trunk Telephone Cables.—A. BEAVIS.—The author explains how the loaded underground trunk telephone lines of the Post Office Department in England are balanced by the resultant capacity method. The balancing of cables divides itself into three distinct branches—namely, testing, selecting and jointing—the manner of jointing adjacent cable lengths depending upon the predetermined selection from original tests. The wire-to-wire and wire-to-ground capacities of balancers are obtained by means of a double-bridge arrangement, in which a simultaneous balance is required, by a process of gradual elimination, necessitating a number of previous balances on each bridge until the telephone is silent in both positions of the switch.—*Electrician* (*England*), March 21, 1924.

Miscellaneous

Broadening Field of Service for Power-Plant Engineers.—W. SLADER.—There are many reasons justifying the conviction that present conditions call more plainly than ever before for the handling of power engineering matters by men trained for this work and who devote their time to nothing else. The author presents a review of the power field in the hope that it will be of some general interest, especially to those who are in executive positions where these matters form a part of many duties.—*Power*, March 11, 1924.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Increase of Hydro Energy

Geological Survey Estimates Three-Year Gain in Developed Water Power at 15 per Cent

THE United States Geological Survey has just brought up to date its record of developed water power in the United States. The new figures show that there are now in the country about 3,200 water-power plants of 100 hp. or more, having a total capacity in installed waterwheels of 9,086,958 hp., an increase of about 1,160,000 hp., or nearly 15 per cent, over the total in 1921. Of the present total, 81 per cent is in public utility plants and 19 per cent in manufacturing plants.

New York, with 1,542,983 hp., is still the leading state in developed water power; California, with 1,451,830 hp., is a close second; Washington, with 480,356 hp., is third; Maine, with 473,188 hp., is fourth, and North Carolina, with 431,500 hp., is fifth, displacing Montana, which ranked fifth in 1921.

The total potential water power available 90 per cent of the time is given as 34,818,000 hp. and that available 50 per cent of the time as 55,030,000 hp. The present estimate is based largely on reports that include only feasible sites, and it therefore represents a potential power that can be developed when a market is available; yet it does not differ very materially from the estimate made in 1908. Allowing for the difference in assumed efficiency and for the inclusion in this estimate of the United States' share of the potential power on Niagara and St. Lawrence Rivers, the present estimate of the potential power available 90 per cent of the time is about 21 per cent higher than the estimate in 1908, mainly because of the assumed use of stored water at places where detailed examinations and surveys have shown existence of good reservoir sites. For the same reason the estimate of power available 50 per cent of the time is 4 per cent higher.

Edison Scheduled to Unveil Bust of Joseph Henry

Ten additional busts are to be unveiled at the Hall of Fame at New York University, New York City, on the afternoon of Tuesday, May 13. Among these are those of two men whose fame is based on scientific and engineering achievements — Joseph Henry and James Buchanan Eads. According to the invitations issued by the director of the Hall of Fame, Dr. Robert Underwood Johnson, Henry's bust will be unveiled by Thomas A. Edison and the speech recounting the achievements of this pioneer American electrotechnician, who invented the first operative telegraph and made an independent discovery of electromagnetic induction, will be made by General John J. Carty, vice-president American Telephone & Telegraph Company. Dr. George F. Swain, professor of civil engineering at Harvard University, will make the speech commemorating the varied achievements of Eads. A tablet was erected to Joseph Henry ten years or so ago at the Hall of Fame, but the provision of a bust was deferred until now.

Dr. Nichols Dies Suddenly

Distinguished Scientist Was in the Act of Addressing National Academy of Sciences

WHILE delivering an address on Tuesday last before a great audience of scientists gathered in Washington for the three-day meeting of the National Academy of Sciences and the National Research Council, Dr. Ernest Fox Nichols, director of pure science in the Nela Research Laboratory at Cleveland, was overcome by illness, sat down at the rear of the platform and died almost instantly. Dr. Nichols' address was given in the new building of the National Academy of Sciences, which had been dedicated on the previous day. The program of the meeting was immediately halted, and the greatest concern was manifest on every hand. Prof. A. A. Michelson, president of the academy, was one of the first to reach Dr. Nichols' side, but he was already beyond aid, although he had shown no sign of distress before his movement to sit down.

DR. E. F. NICHOLS

Dr. Nichols was president of Dartmouth College, Hanover, N. H., from 1909 to 1916; from 1916 to 1920 he was professor of physics at Yale University, and in April, 1921, he was elected president of the Massachusetts Institute of Technology to succeed the late Dr. Richard C. Maclaurin. He was inaugurated in June of that year, but never assumed the duties of the office because of an attack of illness which shattered his health. He was able, however, to resume work at the Nela Research Laboratory interrupted by his appointment to the Massachusetts institution.

Born at Leavenworth, Kan., June 1, 1869, Dr. Nichols was still under fifty-five, but had achieved an international reputation as a physicist, educator and expert in radiation and similar fields. He was educated at the Kansas Agricultural College, Cornell University, the University of Berlin and Cambridge University and held, besides, honorary degrees from seven institutions of learning in America. Before going to Dartmouth he had taught physics at Colgate and Columbia and had been a research associate at the Carnegie Institution in Washington and attached to the Bureau of Ordnance in the United States Navy, where he developed valuable optical devices.

Record Transmission Span

Tacoma Plans to Construct Two Over Puget Sound Outlet with a Length of 6,153 Ft.

TO TRANSMIT power from its Lake Cushman hydro-electric project the city of Tacoma, Wash., plans to construct two 110,000-volt transmission spans 6,153 ft. long over "the Narrows," one of the outlets to the ocean from Puget Sound. This will establish a new world's record for such spans, exceeding the length of the 5,010-ft. span over the Little Tennessee River in North Carolina by 1,143 ft.

Thorough investigation and tests led to the adoption of the messenger-span system of supporting the electrical conductors instead of the self-supporting conductor type. The messenger span will consist of 1¼-in. galvanized concentric-wound plow-steel cable. The electrical conductors, composed of 300,000-circ.mil copper or its aluminum equivalent, will be supported on suspension insulators every 400 ft. from the messenger cable. It was found that the spacing of the supporting suspension insulators on the messenger wire was an important factor in damping out vibration and that with the proper spacing vibration could be almost entirely eliminated.

This type of construction obviates

the problem of insulation of a large steel cable and fatigue and failure of the span due to vibration. The St. Lawrence span, 4,801 ft. long, is of this type and no failures have occurred. The messenger cables will pass over large sheaves on the towers and continue on to heavy anchors deeply embedded in the earth. To insure continuity of service and to be able to make necessary repairs, two spans will be constructed, each supported on its own steel towers. The spans will be designed for a loading of ½ in. of ice and a wind pressure of 8 lb. per square foot on the projected diameter of the ice-covered cable at 0 deg. F. When loaded with ice without wind the sag will be 368 ft., giving a clearance over the water of 200 ft. Structural steel will be used on the towers. Those on one shore will be 272 ft. high, while the other two will stand 325 ft. above the ground.

Because of the swift tidal currents in the Narrows, the rocky, uneven bottom and the high, steep bluffs on the shore, the use of submarine cables was considered impracticable. To go around the lower end of the sound would necessitate a greatly increased length of transmission line.

Attempt to Connect President with Ford

Mr. Coolidge Makes Prompt Denial—Two Former Cabinet Members Oppose Detroit Manufacturer's Bid— Governor Pinchot Says Muscle Shoals Must Tie In

THE most sensational development in the Muscle Shoals hearings before the Senate committee on agriculture this week was the reading of a telegram sent last December by James N. Miller, a Washington newspaper man, to the Dearborn (Mich.) *Independent*, which is owned by Henry Ford. In this telegram Mr. Miller asserted that he had just had a private interview with President Coolidge and that the President had said to him: "I am friendly to Mr. Ford, but wish some one would convey to him that it is my hope that Mr. Ford will not do or say anything that will make it difficult for me to deliver Muscle Shoals to him, which I am trying to do." President Coolidge made a prompt and emphatic denial of the statement thus attributed to him.

Secretary of War Weeks appeared before the committee and explained his sale of the Gorgas steam plant to the Alabama Power Company last fall. The readers of the ELECTRICAL WORLD are familiar with this transaction. Asked if he thought the government should retain its Muscle Shoals property, Mr. Weeks replied that he did not favor public operation, and if the government was to retain Muscle Shoals the only thing to do was to find a qualified man to handle it.

BAKER AND GARFIELD AGAINST FORD

The Ford offer was criticised by two former members of the Cabinet in testimony before the committee. Newton D. Baker, former Secretary of War, declared that in his opinion the government should retain control of the hydro-electric development, rejecting all private bids. James R. Garfield, former Secretary of the Interior, asserted that the Ford offer would create a great power trust.

Alluding to present offers for Muscle Shoals, Mr. Baker advanced the opinion that the fertilizer consideration is of relatively minor importance. "If some one should invent a chemical process for producing nitrogen, it would be tragic to have this greatest water power east of the Mississippi tied up for 100 years with some uneconomic process," he declared, expressing the belief that such a new process will be discovered. The power from the Muscle Shoals dams should be distributed to make existing industries more efficient and enable them to operate at a lower cost, Mr. Baker said. He opposed giving any individual or private corporation any rights at Muscle Shoals not in conformity with the water-power act, and said a dozen offers such as the Hooker-White-Atterbury bid could be secured by the government.

The rates for power developed at Muscle Shoals should be regulated and any grant there should be consistent with the water-power act, former Secretary Garfield declared. "It is the mere glamour of a name that has attracted people to the Ford offer," he added. The former Secretary differed from Mr. Baker, however, in declaring that he preferred to have an adequate private lease executed rather than to have government operation.

GOVERNOR PINCHOT FOR SUPER-POWER PLAN

Governor Pinchot declared that the power from Muscle Shoals should be linked into a superpower system for the benefit of the entire South, asserting that anything less than this would be a severe blow to the social and economic development of that section. "As a power proposition, the Ford offer is absolutely contrary to the Roosevelt policy as set forth in the water-power act," Governor Pinchot continued, adding that it provided no check on the price consumers would have to pay for power.

H. W. Seaman, president of the American Mining Congress, urged that the navigation question be given more consideration. Production of fertilizer is important, he said, but the power possibilities are of even greater consequence. The Muscle Shoals project should not be considered as a sectional matter, he averred, as the power could be linked in a system to reach to Chicago and to New Orleans.

James Hyde Pratt of Asheville, N. C., and L. J. Folse of Hattiesburg, Miss., declared that the business interests of the South must be safeguarded in a way not guaranteed by the Ford bill.

E. B. Stahlman, publisher of the Nashville (Tenn.) *Banner*, said that the Mayor and people of that city were for Ford.

A. E. C. Wants Muscle Shoals Under Water-Power Act

That no disposition should be made of the government's Muscle Shoals properties until a joint committee of Congress, as recommended by the President in his message of December 6, shall have considered all offers and have made a report, and that the power project should be conducted under the provisions of the water-power act, are the recommendations of the special committee of the American Engineering Council appointed to consider the situation at the request of Senator Norris, chairman of the committee before which the various bills now are. This committee was headed by Fred R. Low, the president of the American Society of Mechanical Engineers. The findings of the Low committee are indorsed by the administrative board of the American Engineering Council, former Governor Hartness, in his capacity as president of the council, having on April 28 sent a letter to Senator Norris strongly supporting them. In this letter Mr. Hartness says:

"In the course of its investigations the committee found nothing to justify the popular belief that the operation of the existing plants at Muscle Shoals will make substantially cheaper fertilizers immediately available.

"The committee further found that recent developments of the synthetic process of nitrogen fixation had materially changed the entire outlook in the art, and it is now quite possible that this process, for the use of which the so far unsuccessful Muscle Shoals Plant No. 1 was designed, may yet yield nitrate at a cost to compete with that obtained from Chile, and Plant No. 1, until recently considered a failure, may be the more valuable of the two constructed by the government for the purpose intended."

Harriman Talks on New England Power Report

Outstanding features of the New England power resources report, which is summarized on pages 877-881 of this issue, were presented April 29 at a joint meeting of the Affiliated Technical Societies of Boston and the Associated Industries of Massachusetts. The speakers were Chairman Charles T. Main of the power investigating committee, Henry I. Harriman, president New England Power Company, and Prof. Dugald C. Jackson of the Massachusetts Institute of Technology, associate members. Supplementing the report, Mr. Harriman announced that an investigation is now in progress to determine the economies of interconnection for six leading New England utilities. Preliminary studies indicate that at least 300,000 kw. spare capacity can be utilized by tying these systems together for maximum effectiveness, representing a saving in capital investment of about $40,000,000.

Mr. Harriman pointed out that the present New England 66,000-volt interconnections have a circuit capacity each of probably not more than 20,000 kw. He forecast the use of 220,000-volt

trunk-line interconnections in this region. Mr. Harriman maintained that the superpower zone should be extended to include the Pittsburgh and Cleveland districts, making the total yearly energy consumption requirements of the zone about fifty billion kilowatt-hours. In a masterly analysis of the hydro-electric resources of eastern Canada the speaker said that these amount potentially to about one hundred billion kilowatt-hours per year. Supplemented by suitable steam plants, these resources are most encouraging in taking a long look ahead with the view of estimating provision for the future power requirements of the greater superpower region.

Alaska Power Projects May Be Abandoned

Print-Paper Manufacture There Thought Impracticable—Federal Commission Refuses New Permit Where One Has Lapsed—Baker River and Other Undertakings

FROM well-informed sources in Washington comes the statement that the dream of the Forest Service of making Alaska the source of America's news-print paper apparently cannot be realized under existing conditions. This is revealed by the inability of the most favorably situated interests to devise any means of reducing costs to the point where they can compete with Canadian and Scandinavian manufacturers. The utilization of the power possibilities of Alaskan streams depends to a great extent on the ability to use the power for the manufacture of pulp and paper. In view of the discouraging outlook facing this well-situated interest, which also is an applicant for rights under the water-power act, it is feared that most of the many applications from Alaska will have to be abandoned.

PIT RIVER COMPANY DENIED PERMIT

The Pit River Power Company has been advised by the Federal Power Commission that its request for a preliminary permit covering two sites on the Pit River in California cannot be granted. The company held a preliminary permit covering substantially the same projects for three years, when it was allowed to expire. The company points out that it has acquired 8,000 acres of land and has expended a considerable sum in preparatory work.

Although one exception to the water-power act has been made by special legislation authorizing a second preliminary permit—in the case of the Dixie Power Company and White River, Arkansas—this action was taken with the express understanding that it was not to constitute a precedent.

The Fresno Irrigation District has applied to the commission for a preliminary permit covering a power project in the Middle and South Forks of Kings River. The project is almost identical with that for which application was made by the city of Los Angeles. That application was rejected last year by the commission when the city failed to give assurances of the prompt development of the project.

The Puget Sound Power & Light Company of Seattle has declared its intention to construct a dam 210 ft. high in the Baker River, a tributary of the Skagit. The company plans to install machinery capable of generating 20,000 hp. As navigation is not thought to be affected by this development, it is probable that the Federal Power Commission will not take jurisdiction.

M. L. Culley of Jackson, Miss., has declared his intention to construct two dams, 30 ft. and 50 ft. high respectively, in the Strong River near Jackson. He estimates that 3,000 hp. can be developed. The project probably will not come within the jurisdiction of the commission.

Utility Information Bureaus for Connecticut and Florida

Connecticut and Florida are the latest states to organize public utility information bureaus. C. G. Willard, an experienced newspaper and publicity man, will have charge of the Connecticut organization as executive secretary, with offices at New Haven. This bureau was formed as the result of the utilities in Connecticut withdrawing from the New England Bureau of Public Service Information in order to carry on more intensive work in Connecticut.

A newspaper man will also direct the Florida Public Utilities Information Bureau—R. J. Holly, former president of the Florida Press Association, editor and publisher of the *Florida Trucker* and former proprietor of the Sanford *Daily Herald*. The two new bureaus make a total for the nation of twenty-seven, covering thirty-five states.

Clear Fused Quartz Made in Electric Furnace

On Monday, April 28, at the Thomson Research Laboratory, Lynn, Mass., the General Electric Company demonstrated the manufacture of clear fused quartz in the electric furnace. Large masses of this material, as free from bubbles and irregularities as the best optical glass, are produced rapidly with small power consumption in a radiation furnace recently perfected after many years of research. At this demonstration a batch of clear fused silica rod, as perfect in form as ordinary glass rod, was produced in eighteen minutes, starting with a cold furnace.

The power consumed in this furnace is only 5 kw.-hr. to 8 kw.-hr. per pound of product. The resistor is a graphite tube connected at the ends by means of water-cooled copper terminals to a source of current. In this particular furnace 50 volts alternating current supplies about 1,800 amp. The resistor becomes incandescent and heat is radiated into the crucible placed within it.

Detroit Edison Company to Reduce Rates

Action taken by the Mayor and city authorities of Detroit in instituting steps preliminary to a review of the Detroit Edison Company's charges with a view to reduction in rates has been met with a statement from President Alex Dow that the company had intended to reduce the rate to certain commercial classes voluntarily and had already petitioned the Michigan Public Utilities Commission for a new schedule. He pointed out that by this action the company voluntarily surrendered between $300,000 and $400,000 in revenue. Rates to residential users could not be lowered, Mr. Dow said, since they are virtually on a pre-war basis.

Further reductions under consideration by the company would also affect commercial consumers. If the city persists in going forward with legal proceedings to hasten action, Mr. Dow intimated that the probable outcome would be that the company would stand on its legal rights, which might result in higher rates.

Los Angeles to Vote on a New Power Bureau Bond Issue

A bond issue of $21,000,000 for the Bureau of Power and Light of the city of Los Angeles, said to be for extensions and betterments and substations for the city distributing system over a period of three years, will be placed before the voters of the city on May 6. A thirty-five-million-dollar bond proposal, which included $25,000,000 to start development on the Colorado River, failed to receive the necessary two-thirds majority at the city election in June last year, and the Power Bureau is said to be badly in need of funds to finance extensions, betterments, substations and so on. The opponents of the proposed issue contend that the work can be done for less than $11,000,000, and they suspect that a part of the money is to be spent for a purpose not revealed. It is further argued that, since the city is already heavily bonded, water bonds, school bonds and bonds for other vital requirements should be voted before the power bonds.

Cattle-Disease Laws Hamper California Utilities

California utilities, particularly those operating in the San Joaquin Valley, have suffered considerable inconvenience and trouble from the strict quarantine regulations which are being enforced to stamp out the hoof-and-mouth disease which is sweeping through California live-stock herds. The San Joaquin Light & Power Corporation and the Southern California Edison Company are co-operating in every way with state and national authorities to stamp out the epidemic. In some instances the power companies have had to abandon meter reading in the rural districts and suspend all construction work. Where meter reading is still permissible the men have to wear rubber boots and coats and dis-

infect these each time they visit a farm. In cases where meters cannot be read consumers are being billed on the basis of the average of their previous bills. The San Joaquin company is endeavoring to get customers to read their own meters in the rural districts by sending out post cards.

Great Lakes Division of the N. E. L. A. Elects Officers

At the annual business meeting of the Great Lakes Geographic Division, N. E. L. A., held at Chicago on April 16, the following were elected officers for the year beginning July 1: President, Marshall E. Sampsell, Chicago; vice-presidents, B. F. Lyon, Beloit, Wis.; Thomas F. English, South Bend, Ind., and A. C. Marshall, Detroit; secretary-treasurer, R. V. Prather, Springfield, Ill.

It was decided to hold the annual convention of the division jointly with the Indiana Electric Light Association at French Lick Springs, Ind., September 24 to 27 inclusive. At the meeting numerous committees were heard from, including the power survey committee, which has just completed its second annual report. This report will be of widespread interest to the industry, as the Great Lakes Division is the first geographic division of the National Electric Light Association to attempt anything of this character and is therefore being watched by the other divisions with a great deal of interest.

California Fishing Interests Fight Power Men

Representative Raker of California has introduced a bill in the House which would amend the federal water-power act so as to take the Klamath River in California out of the jurisdiction of the Federal Power Commission and to require that no power project shall be developed on this river without congressional action. There are two applications before the Federal Power Commission involving high dams in the Klamath River, which the fishing interests and the California State Fish and Game Commission protest will eliminate the run of salmon in the river. This river has been termed the last stronghold of salmon on the Pacific.

A bitter and protracted controversy has been waged in California between the Fish and Game Commission and the State Division of Water Rights. The Federal Power Commission, not wishing to become involved in a controversy between two state bureaus, has thus far taken the position that it would not act on the power applications until the applicants perfected their water rights under state law. It is understood that the Division of Water Rights of California is now planning to issue the water permits on these two power projects. The introduction of the Raker bill would indicate that the fish interests fear that the Federal Power Commission will grant permits once the state permits have been secured. The bill has little chance for passage. Its acceptance would open the way for other attacks on the commission's jurisdiction.

Northeastern A. I. E. E. to Hold Two-Day Meeting

A convention of a new type will be held under the auspices of the Northeastern District of the American Institute of Electrical Engineers at Worcester, Mass., on June 5 and 6. This meeting has been arranged through the combined efforts of the several sections in the Northeastern District working under the vice-president of the district. Three technical sessions and several special features, including an address by President H. J. Ryan, have been scheduled. The technical papers, which will be presented at the Worcester Polytechnic Institute, will discuss transmission, vacuum tubes and radio, temperature measurements, insulators, transformers for testing purposes, electrical machinery and windmill generation of electrical energy. Special addresses and other features have been scheduled to follow a banquet on Thursday evening, and there will be provision for recreation. The electrical machinery committee is taking advantage of the meeting to hold a conference on the afternoon of the last day.

The program planned includes the following features:

THURSDAY, JUNE 5

Morning.—"Very Large Transmission Systems," Percy Thomas, consulting engineer; "The Functions, Applications and Construction of the Various Vacuum Tubes," Dr. A. W. Hull, General Electric Company; "Thermotel," E. D. Treanor, General Electric Company; "Windmill Generator Plants," F. C. Doughman, Westinghouse Electric & Manufacturing Company.

Afternoon. — Excursion to industrial plants; meeting of executive committee of Northeastern District.

Evening.—Banquet, Bancroft Hotel, with address by President H. J. Ryan; "The Industrial Compass," N. F. Hanley, General Electric Company; "Some Interesting Features of the 'Bucking Bronco,'" Prof. C. W. Henderson, Syracuse University.

FRIDAY, JUNE 6

Morning.—"The Development of a Suspension-Type Insulator," Prof. H. B. Smith, Worcester Polytechnic Institute; "Transformers for High-Voltage Testing," F. B. Cahall, General Electric Company; "An Efficient Tuned Radio-Frequency Amplifier," Fred Drake and G. H. Browning.

Afternoon. — Excursion to industrial plants; meeting of electrical machinery committee.

Evening.—"Effects of Expansion and Contraction on Insulation of Long Armature Coils," T. S. Taylor, Westinghouse Electric & Manufacturing Company; "Short Circuits of Alternating-Current Generators," C. M. Laffoon, Westinghouse Electric & Manufacturing Company; "Torque Pulsations in Single-Phase Motors," P. L. Alger and A. L. Kimball, General Electric Company.

Alabama Power Company Keeps Up Fight for Loop

The fight on behalf of the Alabama Power Company for the right to construct a circle of electric transmission lines through north Alabama connecting with Muscle Shoals has been transferred from the Public Service Commission to the Circuit Court in Montgomery. On petition of the Huntsville Manufacturers' Association and the Lincoln Mills of Alabama the court cited President A. G. Patterson and H. F. Lee and Frank P. Morgan, associate members of the Public Service Commission, to appear May 1 and show why the court should not issue a writ of mandamus requiring the commission to render a decision on the petition of the Alabama Power Company. It is asserted that the Lincoln Mills are now completing a large cotton mill at Huntsville which will be without power for operation until the transmission circle is competed.

The Alabama Power Company now has a transmission line to Huntsville by way of Gadsden and another from Birmingham to Sheffield, but it has no authority to connect the two lines. The decision of the Huntsville manufacturers to take the matter to the courts is a departure in Alabama utility procedure. Many cases have previously been carried from the commission to court but not before the decision was rendered.

Utilities Commissioners Aim at Uniform State Practices

The special legislative committee of the National Association of Railway and Utilities Commissioners, of which Lewis E. Gettle, chairman of the Wisconsin Railroad Commission, is chairman, has completed a preliminary report of its findings on the public utility laws now in force in the different states of the Union. This interesting report, the first of its kind ever prepared, which was drawn up by Mr. Gettle in conjunction with other members of the committee, reveals a rather wide variation of rate and service obligations governing the operation of all divisions of the public utility industry. This report, with subsequent amendments and additions, will be presented at the next annual convention of the national association, at which time recommendations will be made for more uniform regulatory practices throughout the nation.

In twenty-four states, the report says, the commissioners are appointed by the Governor; in twelve states they are elected from the state at large; in five states they are elected by utility districts or other divisions of the state; in Oregon two are elected by such districts and one from the state at large; in two states (Connecticut and South Carolina) the commissioners are elected by the General Assembly. In Nevada the state engineer serves as a commissioner ex officio and the two other members are appointed by the public service board.

Steam and interurban railroads are included in the regulation of all states; express companies are included in all states; street railways are included in all except Kansas, Iowa, Kentucky and Michigan; telephone lines are regulated in all except Iowa, Michigan, Minnesota, Texas and South Carolina; electric companies in all states with the exception of Florida, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Nebraska, South Dakota and Texas; gas companies in all states except Florida, Iowa, Kentucky, Minnesota, Mississippi, Nebraska, South Dakota and Texas; water companies in all but fourteen states; heating companies in nineteen states. Eleven states subject local municipally owned public utilities to the jurisdiction of the state regulatory bodies.

Small-Plant Problems at New Orleans

Special Session Devoted to Their Consideration Brings Out Unusually Well-Shared Discussion—Papers Tell How to Get Facts Home to the Public

BEFORE the joint New Orleans convention of the Southwestern Public Service Association and the Southwestern Division of the National Electric Light Association adjourned last week a special session was held for the discussion of small-plant operating problems. This session and the accounting sessions were conducted on a similar basis, that of taking up specific timely problems or practices for discussion without having any papers scheduled in advance. As a result there was more active participation in the discussions than where the major portion of the time is given over to presentation of papers. As pointed out in last week's report of the earlier sessions of the convention, the Commercial Section confined its meetings to the presentation of two papers each, thus allowing more time for discussions. The technical sessions, however, were so filled with committee reports and papers that relatively little time was left.

"Building the True Conception of Utilities in the Public Mind," by E. F. Wickwire, Mansfield, Ohio, was one of the outstanding addresses on public relations. Rendering good service, the speaker pointed out, while it is the basic essential of good relations, cannot create good will without publicity, and publicity unsupported by service is less effective. The company must sell itself as well as its service to the public. Good public relations, Mr. Wickwire said, require knowing the public, knowing the utility employees and knowing the press. Furthermore, this activity requires executives just as high-priced as does the operating department—preferably a vice-president in charge of sales and public relations who will work in close co-operation with the vice-president in charge of operation.

Some Significant Facts

Several facts were emphasized by W. H. Sawyer, East St. Louis, which most utility men know but which have not been sufficiently impressed on the public; for example, that the capitalization of utilities in different localities is often greater than that of the banks in the same territory, and hence they have greater influence on prosperity than the banks. Utilities, the speaker declared, should be sufficiently manned to give all their men time to take part in association activities and to analyze their problems. Good operating service and frank information about the company are more important than rates in promoting good will, Mr. Sawyer contended. The public should be informed what proportion of the money it pays utilities is really indirect taxation resulting from failure to place the taxes where they belong.

W. H. Johnson, president of the national body, said that among information which the public should possess were the facts on the amount of money invested in the electric utility business, on relative expenses and rates now and ten years ago, on the coal saving which will be effected by water-power plants under construction, on handicaps in developing mouth-of-mine plants and on the work being done to bring about more extensive rural service and extend customer ownership.

Women employees' contributions to the subject of public relations included the presentation in printed form of five prize-winning essays on "Our Contact with the Home," the reading of the one awarded first prize, which was by Annie E. Morgan, Dallas, and an entire session devoted to the discussion of public relations responsibilities of women employees in small and in large communities. Two papers were presented, one on each aspect of this subject, by Mary A. Neidermeier, Longview, Tex., and Mary Lisle Van Sant, Oklahoma City, respectively.

Small-Plant Problems

The session on small-plant problems, was so successful in leading small-plant men to exchange experiences that a resolution was passed asking the executive committee to provide two days for such sessions at future meetings. Among the subjects discussed were financing consumers' extensions in outlying districts, complaints about meter readings and changes during customers' absence, street lighting in small towns and whether the small plant can profitably compete in industrial service with gas or oil engines.

Complaints regarding meter readings, the consensus of opinion was, can be eliminated to a great extent by education of the public regarding the reasons for the bills, by comparing bills with previous bills before mailing and by maintaining a sympathetic attitude when complaints are made. Testing a meter in the customer's presence has been found very satisfactory by some companies. Energy theft was cited as one of the biggest problems which utilities have to face in the South. If evidence of theft is obtained, the general practice is to show it to the customer and then disconnect service until an adjustment is made.

The practice of the Northern States Power Company in furnishing street lighting from multiple circuits energized by distribution transformers and controlled by time clocks and relays was cited by one speaker as a possible way of lessening the cost of street lighting, reducing hazard, improving power factor and simplifying line construction. A question was raised, however, regarding the reliability of the relays. One company's representative declared that it would not be economical to install the multiple system except in congested districts.

To meet the competition of oil and gas engines the representative of one company said that it engages disinterested outside help to advise users regarding comparative cost of service, while another company, it was brought out, merely enumerates the items which go into expense and lets the customer put his own figures opposite each item, advising him where the figures are far from actual values.

Commercial and Technical Topics

Among commercial proceedings not reported last week were a discussion on power factor in rate clauses and one on possibilities of increasing revenue through more adequate commercial lighting. W. C. Blair, Dallas, discussed the general subject of rates and methods of compensating for power factor. The maximum and minimum limits to rates, he pointed out, should be the value of service and cost of service if both the customer and the utility are to be satisfied. S. W. Trawick, New Orleans, and J. C. Lamb, Baton Rouge, La., emphasized the fact that the possibilities of increasing revenue by providing more adequate commercial lighting have been overlooked and urged companies to engage men who understand and can sell scientific practical illumination.

Excellent papers presented before the technical sessions included one on recent comprehensive tests of the Fynn-Weichsel motor by Hans Weichsel; one on transmission-line right-of-way by Joe E. Ward, Dallas; one on rural-line construction by R. F. Danner, Oklahoma City, and one on a revised system of accounting for the plant operator by R. H. Forney, Dallas.

Discussions in the accounting session touched on payroll standardization, classification of accounts, purchasing and storeroom accounting, budgets, customers' records and billing methods, fixed-capital records, preservation of records and government reports and tax renditions.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, Oklahoma City, was elected president of the Southwestern Geographic Division of the N. E. L. A., and G. W. Fry, president of the West Texas Utilities Company, Abilene, Tex., was elected president of the Southwestern Public Service Association.

Louisiana Utilities Association Will Teach Public

Meeting at New Orleans last week under the chairmanship of L. S. Westcoat of Shreveport, La., the Louisiana Utilities Association amended its constitution so as to admit public service companies of every kind to membership. This had previously been restricted to electric light and power, electric railway, communication, gas and water utilities.

Legislation was the chief topic discussed, and the necessity of educating the public to discriminate between good and bad bills affecting public utilities was emphasized. A committee was authorized to pursue this object, and it will examine all utility bills introduced and acquaint the public with their bearing. It was also the consensus of opinion that the public should be taught that the regulation of utilities implies also their protection against competition.

Chicago Electric Truck Show to Be Held Next Week

The latest models of electric trucks will be exhibited at the third annual electric truck show in Chicago, to be held at the new electric garage of the Commonwealth Edison Company, Jackson Boulevard and Sangamon Street, on Friday and Saturday, May 9 and 10. All the equipment required for a system of electric transportation—garage, trucks, batteries and charging equipment—will be assembled. The show will be open from 11 a.m. to 9 p.m. and there will be no charge for admission.

Federal Government Seeks to Recruit Its Engineers

Although no unusual number of vacancies exists or is in prospect in the engineering services of the federal government, the Civil Service Commission is exerting strong efforts to interest a large number of young professional men in the examinations for junior engineers which will be held throughout the country May 9. It is hoped by the commission to secure a sufficient list of high-class eligibles at this examination to take care of the expanding needs of the federal government for technical men and make up the losses suffered by turnover. Optional subjects include these divisions of engineers: Aëronautical, agricultural, ceramic, chemical, civil (general), electrical, electrochemical, fisheries, hydraulic, materials, highway, industrial, irrigation and drainage, mechanical, mining, petroleum, radio and structural.

Under the new classification act, the entrance salary for junior engineer positions within the District of Columbia will be $1,860 a year after June 30, with advancement in pay without change in assignment to $2,400 a year. The highest salary paid to an engineer under the classification is $7,500 a year unless a higher salary is especially authorized by Congress. The higher-salaried positions are filled through promotion whenever possible.

Insull Issues Statement on Bankers' Shares Scheme

Samuel Insull, president of the Commonwealth Edison Company, Chicago, issued the following statement on April 22, subsequently printing it as an advertisement headed "Warning":

"A newspaper advertisement appearing this morning offers so-called bankers' shares in the United American Electric Companies. The advertisement states that these shares represent stock in ten companies including the Commonwealth Edison Company. The Commonwealth Edison Company wishes to announce, first, that it has not authorized this use of its name in the advertised plan; second, that the Commonwealth Edison Company is not in any way interested in the United American Electric Companies. It is the apparent purpose of the advertised plan to collect shares of stock of corporations and issue its own securities against them. This in so far as it involves the Commonwealth Edison Company should not appeal to any one familiar with the history and policy of the company. The Commonwealth Edison Company has always sought to place its stock as issued with its own stockholders and customers. The company believes that it is to the advantage of any investor who wishes to become interested in the stock of the Commonwealth Edison Company to buy the stock upon the market, receive dividends directly from the company and become entitled to receive the right to subscribe at par for a proportionate part of new stock that may from time to time be issued. The stock of the Commonwealth Edison Company has the added advantage of being in the hands of its stockholders free from state taxation in Illinois."

Utility Financing Unusually Active During April

PUBLIC sales of electric light and power securities to the value of $92,950,000 were offered by investment houses during the month of April, a total indicative of the strong demand at the present time for sound investment securities. The figure is the highest reached during any month of the year and represents an increase of more than $27,000,000 over that recorded for April, 1923. The rate of return yielded the investor, which has been on the decrease since February, took an upward turn during the past month, reaching the 6.37 point. Long-term securities continued to predominate, and the largest individual offering was the issue of $12,500,000 in gold bonds of the Pacific Gas & Electric Company, offered at 96 and yielding 5.78.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN APRIL

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Consolidated Power & Light Co. (W. Va.)	$1,000,000	....	Cumulative preferred stock	Additions	7	93½	7.50
Adirondack Pwr. & Lt. Corp. (N. Y.)	1,150,000	26	First and refunding mortgage gold bonds	Construction	6	100	6
	1,000,000	....	Cumulative preferred stock	To reimburse for extension expenditures	7	97½	7.15
Memphis Pwr. & Lt. Co. (Tenn.)	1,000,000	24	First and refunding mortgage gold bonds, series A	Construction expenditures and other corporate purposes	5	91	5.70
Northern States Power Co. (Minn.)	6,000,000	24	First lien and general mortgage gold bonds, series A	Construction	6	99½	6.04
Southwestern Power & Light Co.	3,500,000	19	First lien gold bonds	Refunding and other corporate purposes	5	88½	6
	1,000,000	....	Cumulative preferred stock	Refunding and other corporate purposes	7	96½	7.25
Yuba River Power Co. (Cal.)	1,150,000	1–25	First (closed) mortgage serial gold bonds	Construction purposes	6	....	*6–6½
San Joaquin Lt. & Pwr. Corp. (Cal.)	750,000	....	Cumulative prior preferred stock	Additions and extensions	7	98	7.14
West Penn Railways Co.	3,500,000	3	Gold debentures	Additions and other corporate purposes	6½	99	6.88
Consumers' Power Co. (Mich.)	8,500,000	30	First lien and unifying mortgage gold bonds	To reimburse for construction expenditures	5½	95½	5.82
Jersey Central Power & Light Corp.	1,250,000	....	Cumulative participating preferred stock	To acquire stock of other companies and for additions	7	92½	7.50
Metropolitan Edison Co. (Pa.)	2,150,000	29	First and refunding mortgage gold bonds, series C	To reimburse for capital expenditures	5	89½	5.75
Pennsylvania Electric Corp.	5,000,000	30	Sinking-fund gold debentures	Acquisition of securities of other companies and other corporate purposes	6½	93½	7
Pennsylvania Power & Light Co.	2,000,000	....	Cumulative preferred stock	Construction	7	100	7
Standard Gas & Electric Co. (N. Y.)	7,500,000	....	Cumulative prior preference stock	Refunding and additions	7	93½	7.50
Columbus Ry., Pwr. & Lt. Co. (Ohio)	2,250,000	17	Refunding mortgage gold bonds	To reimburse for capital expenditures and construction	6	100	6
Alabama Power Co.	3,000,000	27	First mortgage lien and refunding gold bonds	Construction	6	100	6
Consolidated Gas, Electric Light & Power Co. of Baltimore	2,000,000	....	Cumulative preferred stock, series C	Additions	6½	101	6.45
Otter Tail Power Co. (Minn.)	400,000	15	General mortgage and refunding gold bonds, series C		6½	99½	6.55
Pacific Gas & Electric Co. (Cal.)	12,500,000	28	First and refunding mortgage gold bonds, series C	Additions	5½	96	5.78
Birmingham Electric Co. (Ala.)	8,000,000	30	First and refunding mortgage gold bonds	Refunding and new capital	6	97½	6.18
American Power & Light Co. (N. Y.)	5,000,000	92	Gold debenture bonds, American series	Working capital and other corporate purposes	6	93½	6.40
Indiana Power Co.	700,000	17	First lien and general mortgage gold bonds, series B	To reimburse for additions and for other corporate purposes	6½	99	6.60
Arkansas Light & Power Co.	1,650,000	30	First lien and refunding mortgage sinking fund gold bonds	Construction	6	92	6.63
Niagara, Lockport & Ontario Power Co. (N. Y.)	3,000,000	....	Cumulative preferred stock	General corporate purposes	7	102½	6.89
Edison Electric Illuminating Co. of Boston†	8,000,000	1	Notes	Refund bank loans	..	...	.....
Total	$92,950,000						

* According to maturity. † Offered on a 4.80 interest basis.

N. E. L. A. 1924 Convention Program

General and Executive Sessions

TUESDAY, MAY 20, 9:30 A. M.

Address of welcome, Mayor Edward L. Bader, Atlantic City.
Address, President Walter H. Johnson.
Report of treasurer.
Report of membership committee, H. K. Mohr.
Report of Managing Director Aylesworth.
Report of constitution and bylaws committee, W. C. L. Eglin.
National Section Reports: Public Relations, H. T. Sands; Accounting, W. A. Jones; Commercial, N. T. Wilcox; Technical, H. P. Liversidge.
Report of engineering committee of joint general committee of Bell Telephone System and N.E.L.A., Bancroft Gherardi and R. F. Pack.

WEDNESDAY, MAY 21, 9:30 A. M.

Report of educational committee, F. R. Jenkins.
Report of exhibition committee, C. L. Pierce, Jr.
Address, "History Links Baltimore with N. E. L. A.," Douglas Burnett, commercial manager Consolidated Gas, Electric Light & Power Company.
Report of lamp committee, Frank W. Smith.
Report of committee on relations with financial institutions, M. S. Sloan.
Address, "The Press and the Public Utilities," W. P. Beazell, assistant managing editor New York *World*.
Address, "Giant Power," Governor Pinchot of Pennsylvania.
Address by speaker to be announced.

THURSDAY, MAY 22, 9:30 A. M.

Report of committee on company employees' organizations, T. G. Spates.
Report of memorial committee, W. H. Onken, Jr.
Report of water-power development committee, F. T. Griffith.
Report of rural electric service committee, G. C. Neff.
Report of Committee on Relation of Electricity to Agriculture, E. A. White.
Address, "Relation of Wholesale Manufacturing Costs to Price of Products Delivered to Retail Customers," Prof. D. C. Jackson, Massachusetts Institute of Technology.
Address, H. G. Taylor, president National Association of Railway and Utilities Commissioners.
Address, "The Trend of Court Decisions and Legislation," Carl D. Jackson, counsel N. E. L. A.

FRIDAY, MAY 23, 9:30 A. M.

Report of committee on Doherty and Billings prizes, A. S. Loizeaux.
Report of wiring committee, R. S. Hale.
Report, United States Chamber of Commerce, National Industrial Conference Board, John W. Lieb.
Report of rate research committee, Alex Dow.
Report of federal taxation committee, Philip Gadsden.
Report of insurance committee, Charles B. Scott.
Report of committee on contact with Department of Commerce, G. H. Harries.
Report of Joint Committee for Business Development, M. R. Bump.
Election of officers and members executive committee.

Technical Sessions

TUESDAY, MAY 20, 2:30 P. M.

Address, Chairman H. P. Liversidge.
Report of accident prevention committee, Charles B. Scott.
Report of electrical apparatus committee, H. C. Albrecht.
Report of hydraulic power committee, S. S. Svenningson.
Report of inductive co-ordination committee, R. N. Conwell.
Report of meter committee, B. Currier.
Report of prime movers committee, Nicholas Stahl.
Report of overhead systems committee, W. G. Kelley.
Report of underground systems committee, W. H. Cole.

WEDNESDAY, MAY 21, 2:30 P. M.

Address, "Accident Prevention in the Electrical Industry," R. F. Pack, Northern States Power Company.
Award of Insull medals, Homer E. Niesz.
Address, "Budgeting Engineering Operations," Milan R. Bump.
Address, "Low-Temperature Distillation of Coal," V. Z. Caracristi, New York.
Address, "A City Transmission Network," John C. Parker, Brooklyn Edison Company.

THURSDAY, MAY 22, 2:30 P. M.

Address, "Economics and the Engineer in Utility Management," Alex Dow, Detroit Edison Company.
Address, "The Engineer's Part in the Future Development and Management of the Industry," John W. Lieb, New York Edison Company.
Address, "Mutual Rights and Duties of Utilities on the Highways," Hon. David F. Simpson, former Associate Justice Supreme Court of Minnesota.

Public Relations Sessions

MONDAY, MAY 19, 2:30 P. M.

Address, Chairman H. T. Sands.
Report of Information Bureau, H. C. Abell.
Address, "The Public Utility Information Bureau Directors," B. J. Mullaney, director Illinois Committee on Public Utility Information.
Address, "The Newspaper Man's View of Public Relations," F. Lauriston Bullard, associate editor Boston *Herald*.
Address, "The Committee Chairman's Viewpoint," P. H. Gadsden, United Gas Improvement Company, Philadelphia.

TUESDAY, MAY 20, 2:30 P. M.

Report of committee on employee relations with the public, L. B. Herrington.
Report of manufacturers' advertising committee, P. L. Thomson.
Report of public speaking committee.
Report of women's public information committee, Miss R. E. McKee.
Paper, "Lighting Educational Committee," J. E. Davidson.
Announcement of winners of *Forbes Magazine* prize contest on public relations, B. C. Forbes.
Prize-winning paper in contest.

WEDNESDAY, MAY 21, 2:30 P. M.

Report of committee on co-operation with educational institutions, J. C. Parker.
Address, "Public Utility Courses at Harvard," Wallace B. Donham, dean Graduate School of Business Administration.
Address, "Higher Educational Institutions and the Public Utilities," Prof. C. O. Ruggles, Ohio State University.
Address, "Public Education and Public Utilities," Assistant Dean John T. Madden, New York University.

THURSDAY, MAY 22, 2:30 P. M.

Report of customer ownership committee, Milan R. Bump.
Address, "Customer Ownership on the Pacific Coast," John B. Miller, president Southern California Edison Company.
Address, "Customer Ownership from the Viewpoint of Regulators," W. D. B. Ainey, chairman Pennsylvania Public Service Commission.
Address by speaker to be announced.

Public Policy Committee Session

WEDNESDAY, MAY 21, 8:30 P. M.

Address, U. S. Senator Arthur Capper.
Report of public policy committee, Martin J. Insull.
Report of Charles A. Coffin prize committee, Walter H. Johnson.
Award of Coffin medal.
Address, Secretary Hoover.

Accounting Sessions

TUESDAY, MAY 20, 2:30 P. M.

Address, Chairman W. A. Jones.
Report of budget committee, Robert B. Grove.
Report of committee on classification of accounts and annual reports, J. H. Lobban.
Report of committee on customers' records and billing methods, J. F. Ford.
Report of committee on fixed-capital records, M. R. Scharff.
Report of committee on merchandising accounting, P. H. Myers.
Report of committee on pay-roll standardization, A. B. McCoard.
Report of committee on preservation of records, Franklyn Heydecke.
Report of committee on purchasing and storeroom accounting, E. S. Brock.
Report of committee on security holders' records, Francis J. Brett.

WEDNESDAY, MAY 21, 8:30 P. M.

Address, "Accounting Operations and Public Relations," Herbert A. Wagner, president Consolidated Gas, Electric Light & Power Company.
Address, "Accounting from the Engineer's Viewpoint," H. P. Liversidge, Philadelphia Electric Company.
Address, "Résumé of Testimony and Discussion in Recent Hearings Before the Interstate Commerce Commission, Depreciation Section," Carl D. Jackson, counsel N. E. L. A.
Address, "Merchandising Responsibilities," John F. Gilchrist, vice-president Commonwealth Edison Company.
Symposium, "The Accountants' Problem." Led by H. M. Edwards, auditor New York Edison Company.

THURSDAY, MAY 22, 2:30 P. M.

Address, "Budgets — The Value and Necessity of Budget Control in Its Broadest Interpretation," L. F. Musil, treasurer Cities Service Company.
Address, "Cost Accounting," S. C. McLeod, secretary and treasurer National Association of Cost Accountants.
Address, "Education of Accountants for the Public Utility Field," J. T. Madden, American Society of Certified Public Accountants.
Address, "Accounting in Relation to State Regulation," George C. Mathews, chief statistician Railroad Commission of Wisconsin.

Commercial Sessions

TUESDAY, MAY 20, 2:30 P. M.

Address, Chairman Norman T. Wilcox.
Report of Appliance Bureau, J. L. Harvey.
Report of Lighting Bureau, W. T. Blackwell
Report of Power Bureau, V. M. F. Tallman.
Report of Transportation Bureau, Charles R. Skinner, Jr.
Report of customer relations committee, Harold Wright.

WEDNESDAY, MAY 21, 2:30 P. M.

Address, "Promoting Better Illumination," Preston S. Millar, general manager Electrical Testing Laboratories.
Address, "Why the American Railway Express Company Uses 1,800 Electric Trucks," Robert E. M. Cowie, president American Railway Express Company.
Address, "Electricity in the Home," Mrs. Elizabeth McDonald, household editor *Modern Priscilla Magazine*.
Symposium, "Selling Service."
Address, Charles J. Russell, vice-president Philadelphia Electric Company.
Discussion by J. E. Barry, H. D. Shute, F. A. Ketcham and T. O. Kennedy.

THURSDAY, MAY 22, 2:30 P. M.

Address, "Selling Trucks on the Pacific Coast," H. E. Sandoval, Pacific Gas & Electric Company.
Address, "Domestic Refrigeration," T. I. Jones, Brooklyn Edison Company.
Address, "The Big Lighting Campaign Plan," G. E. Miller, Cleveland Electric Illuminating Company.
Address, "Industrial Heating," Frank A. Coffin, Milwaukee Electric Railway & Light Company.
Address, "Why We Believe in the Electric Range and Water Heater," John W. Carpenter, Texas Power & Light Company.

Briefer News

Alabama Power Company to Erect New Office Building.—The Alabama Power Company will soon erect a sky-scraping office building at Sixth Avenue and Eighteenth Street, Birmingham, to cost approximately $1,200,000.

Wisconsin Municipal Plants May Build Lines to Neighboring Towns.—The Attorney-General of Wisconsin has ruled that a Wisconsin municipal electric light and power plant can build a transmission line to furnish neighboring towns with service, this question having arisen when application was made to the Railroad Commission by the Eagle River authorities for permission to construct and operate a transmission line to the towns of Woodruff and Minocqua, about 25 miles distant.

Record Made in Tunnel Construction.—During the week ended April 5 a record of 150 ft. was made by the construction crew working on the Florence Lake tunnel at Camp 63 on the Big Creek hydro-electric project of the Southern California Edison Company. This surpasses the previous record made on the Big Creek project by 10 ft. and establishes a record for tunnel construction in solid granite with 15 ft. cross-section. This record of 21.4 ft. per day compares with the 15 ft. per day average of all camps for the entire year 1923.

Slide Rule for Standard Parts.—A slide rule for finding the dimensions of standard parts has recently been put on the market in Switzerland. A reprint giving a picture and detailed description of this slide rule may be had from the American Engineering Standards Committee, and a sample of the rule can be seen in its office in the Engineering Societies Building, New York. The slide rule is made in two parts, a body and a slide. On the body is printed the standard part whose dimensions are required. For any one setting of the slide all the dimensions are read through rectangular openings in the body. Arrangements are being made to market this slide rule in America.

Unit Development of Deep River in North Carolina Is Advocated.—Plans for the development of Deep River as a single power unit, somewhat in the manner that the Catawba River has been developed by the Southern Power Company, are disclosed in a report made by the North Carolina Economic and Geological Survey. The plans contemplate utilizing the river for a space of 115 miles. This stretch has already on it a number of industrial plants, some using their own power, some buying it from other companies. It is declared that more than double the present amount of power could be obtained by linking up these interests, building reservoirs and conserving the water, and that periods of curtailment or reverting to steam power could be avoided. The fall included in the survey is 612 ft., of which 302 ft. has been developed.

Philadelphia Electrical Engineers to Hear Address on Utility Management.—The Philadelphia Section, American Institute of Electrical Engineers, will be addressed by James Hutchings, vice-president of the United Gas Improvement Company, on May 12, on "Some Problems of Gas and Electric Utility Management." The meeting will be held in the Engineering Building of the University of Pennsylvania at 8 p.m.

Seal Beach (Cal.) Plant Under Way.—The building program of the Los Angeles Gas & Electric Corporation at Seal Beach, which is eventually to cost $10,000,000, is well started, many of the smaller buildings being finished. Excavation is under way for the main plant, the first unit of which will be rated at 30,000 kw. As soon as this is completed other units will be started. Dwight P. Robinson & Company of New York are construction engineers.

Report of Puget Sound Power & Light for 1923. — According to the annual report filed with the State Department of Public Works at Olympia, Wash., the electric light and power revenues of the Puget Sound Power & Light Company, operating in Washington, for the year 1923 amounted to $5,980,778. Operating expenses were $2,104,307, leaving a net revenue of $3,867,470. Assets listed in the report show investment in lines, properties and equipment of $84,821,052.

Meter Schools in the South.—The second electrical meterman's school at the North Carolina State College of Agriculture and Engineering at Raleigh, held recently, was attended by about fifty men, representing not only North Carolina but also Virginia, South Carolina, Alabama, Georgia and other states. The success of this school, the only one in the Southeastern States with the exception of one at the University of Florida, has led to a desire for the establishment of meter schools in neighboring states, particularly Virginia, Alabama and Georgia, and it is likely that the matter will be taken up by the state educational institutions.

Community Power & Light Buys Central Missouri Plants. — The Versailles (Mo.) electric light and power plant, owned for some time by Mrs. D'Arline Holcomb of Bowling Green, Mo., has just been sold along with several other light and power plants in central Missouri, including those at Eldon, Tipton and California, to a company represented by the Community Power & Light Company of St. Louis, of which Wiley F. Corl is president. This new company owns thirty light and power plants in other states. It has also bought the Niangua River water-power site, including the unfinished dam and other property connected therewith, from the Missouri Water Power Company of Lebanon, Mo. The new company will, it is announced, finish the dam within the next few months and will build transmission lines to scores of central Missouri towns. Versailles, being centrally located, will be headquarters for the distributing system. The contemplated expenditure is put at $1,000,000.

Alabama Commission Grants Conditional Permit for Coosa River Dam.—The People's Hydro-Electric Company has been granted a permit to erect a dam on the Coosa River in Alabama by the Public Service Commission of that state on condition that it obtain the requisite authority from the United States government. The petition was strongly opposed by the Alabama Power Company.

Tax on Electric Trucks in California Upheld.—In a suit brought by the Old Homestead Bakery, Inc., of San Francisco against the chief of the state motor vehicle department the court has upheld the constitutionality of the statute providing for a registration fee of $50 for each electric truck. The bakery company had tendered payment of the fee based on $3 for registration and the balance according to weight, and upon its being refused sued on the ground that the tax of $50 was unconstitutional, illegal, disproportionate and arbitrary.

Canadian Water Power in Relation to Coal.—The Water Power Branch of the Department of the Interior of Canada has recently prepared an analysis of the use of water power in Canada for industrial purposes, with particular reference to the saving which has been thus effected in the importation and consumption of coal. This bulletin deals with the annual coal equivalent of developed water power—i.e., the tons of coal replaced by each horsepower of water power in use, the coal consumption and imports by provinces and the corresponding water-power resources and development, the fuel necessities of Ontario and western Quebec and how enormously these necessities have been diminished by water-power development, the strikingly smaller coal consumption per capita in Canada than in the United States in spite of a colder climate, the proportion of water-power and fuel-power in use, and other subjects.

Has Basis of Company Dividends in New York State Been Enlarged?—The Fearon bill, signed by Governor Smith of New York as Chapter 221 of the Laws of 1924, amending Subdivisions 1 and 5 of Section 664 of the penal law, makes it misconduct in office for an officer or director of a stock corporation to make a dividend "except from surplus." Formerly the language was "except from surplus profits arising from the business of the corporation," and the change has aroused discussion as to its application. The State Tax Commission holds the opinion that the meaning of the phrase is unchanged, as surplus always consists of profits. Other authorities, however, declare that the changed wording permits including in surplus unearned income, such as enhanced value above the purchase price of realty, without the actual physical conversion of such property into cash so as to show a money profit. The amendment, of course, affects utility as well as other corporations.

New England Power Company's Report.—Gross earnings of the New England Power Company for 1923 are shown by its annual report to have been $7,468,330, net earnings $2,075,479, and surplus after interest and dividend deductions $318,385. The report as printed for distribution includes a well-illustrated description of the Davis Dam development.

Illinois Power & Light Absorbs Two More Systems.—The Illinois Power & Light Corporation has acquired the properties of the Central Illinois Electric Company, which furnish service in the towns of Buffalo, Lanesville, Mechanicsburg, Illiopolis, Niantic and Harristown. The properties have been placed under the supervision and operation of the Decatur division of the purchasing company. Officials have also announced that the Illinois Power & Light Corporation has acquired the property of the Western Illinois Utilities Company, which renders electric service in the towns of La Harpe, Blandinsville and Stronghurst.

Canadian Capital Develops Water Power of Chihuahua.—Two parallel 90-mile power lines which are being constructed at a cost of $800,000 from the Boquillas dam in Mexico to Chihuahua City by the Compañia Agricola y de Fuerza Electrica will be completed in June. The company, which is financed by Canadian capitalists, has purchased the distribution system in the Chihuahua capital and will supply that city and nearby smelting and mining plants with energy from its hydro-electric plant. Work on this transmission system was started in December, 1922, and has been completed to within a few miles of the Chihuahua capital, where a substation is under construction. Power is produced at the Boquillas dam in a modern plant containing four 9,000-hp. turbo-generators driven by water from Lake Toronto, which ranks among the three or four largest artificial lakes in the world. This reservoir covers 67.6 square miles as compared with the 65.6 square miles covered by the reservoir at Elephant Butte.

Northern New York Utilities Buys Rome Company.—F. L. Carlisle, chairman of the Northern New York Utilities, Inc., has announced that the New York State Public Service Commission has approved the purchase by the Northern New York Utilities, Inc., of the entire capital stock of the Rome Gas, Electric Light & Power Company, which will be merged with the purchasing concern. Work is under way on the construction of a transmission line from Rome to the Oneida-Lewis County line to connect with the company's transmission line delivering power from northern New York to the Utica Gas & Electric Company. A line is also being built from Rome to Altmar, which is to be the connecting point of the Northern New York Utilities, Inc., and the Niagara, Lockport & Ontario Power Company's systems. In connection with the merger it is announced that the copper and brass manufacturing companies of Rome intend to increase their manufacturing facilities substantially.

American Physical Society Meets at Washington.—The regular spring meeting of the American Physical Society was held on April 25 and 26 at the Bureau of Standards, Washington, D. C. Seventy-seven papers were scheduled for presentation, and most of them were actually presented by the authors in abstract. A meeting of the Association of Scientific Instrument Makers was held at the same time. This meeting marked the twenty-fifth anniversary of the founding of the society. Prof. M. I. Pupin was the principal speaker at the banquet and told of the first meeting of the society and of the part which the late Professors Rowland and Webster played in bringing it into being.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

American Society of Mechanical Engineers—Spring meeting, Cleveland, May 26-29. C. W. Rice, 29 West 39th St., New York.

Electric Power Club—Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Northeastern Division, A. I. E. E.—Polytechnic Institute, Worcester, Mass., June 5-6.

American Association of Engineers—San Francisco, June 11-13. C. E. Drayer, 63 East Adams St., Chicago.

Canadian Electric Association—Ottawa, Ont., June 11-13. Louis Kon, 311 Power Bldg., Montreal.

North Central Division, N. E. L. A.—Winona, Minn., June 11-13. H. E. Young, Minneapolis General Electric Company, Minneapolis.

Arkansas Utilities Association—Hotel Eastman, Hot Springs, Ark., June 12-14. R. I. Brown, Arkansas Central Power Company, Little Rock.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 16-20. Frederic Nicholas, 30 East 42d St.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Georgia Electrical Association—East Lake Country Club, Atlanta, June 18-19. W. C. Drake, 75 Marietta St., Atlanta.

Empire State Gas and Electric Association—Commercial Section, Buffalo and Niagara Falls, June 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

Wyoming Utilities Association—Casper, Wyo., June 23-24. H. C. Chappell, Natrona Power Company, Casper.

American Institute of Electrical Engineers—Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Iowa Section, N. E. L. A.—Wahkonsa Hotel, Fort Dodge, June 24-26. M. G. Linn, Des Moines Electric Co., Des Moines.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Northwest Electric Light and Power Association—Gearhart Hotel, Gearhart, Ore., June 25-27. G. H. Guefroy, Pacific Power & Light Company, Portland.

Toledo Company Seeks to Expand.—The Lake Shore Power Company of Toledo has applied to the Ohio Public Utilities Commission for authority to purchase the properties of the Central Light & Power Company of Edgerton and other villages served by the company for $102,000 and also the electric power properties of the Toledo & Indiana Traction Company of Wauseon for $145,000. The Lake Shore company also asks authority to issue 7 per cent preferred stock to cover the purchase price of the properties to be acquired.

Detroit Edison's New Stock Issue.—The directors of the Detroit Edison Company have announced an offering of additional capital stock amounting to approximately $10,851,000, to be subscribed for by stockholders of record May 5 in the ratio of one share of the new for four shares of the capital stock held on that date. The offering is at par, $100. The prevailing market quotation is above 104. As stated in the letter of Alex Dow, the president of the company, to stockholders, the new capital is needed to put the first unit of the Trenton Channel plant into commission by midsummer and to continue the company's construction program.

Shelbyville, Tenn., to Attack Constitutionality of Public Service Commission Law.—An attack on the constitutionality of the law setting up the Tennessee Public Service Commission—particularly the clauses permitting the abrogation of contracts between municipalities and public utility companies—will probably be made by the city of Shelbyville, as the outcome of an effort by the Southern Cities Power Company of Chattanooga to have the commission fix uniform rates in the score of Tennessee cities where the company operates. The commission's engineers found that some of the rates will be decreased while others will be materially increased, and objection to the new schedule was lodged with the commission by the cities affected.

Annual Report of the Northern States Power Company.—The annual report of the Northern States Power Company for 1923, just issued, shows that after payment of the regular dividend on the preferred stock, quarterly dividends at the rate of 8 per cent per annum were paid on the common stock, leaving a balance of $1,580,324 available for amortization, depreciation and surplus, as compared with a balance of $1,134,526 in 1922. Gross earnings were $15,489,790 and net earnings $6,580,991, these figures representing an increase of 11.58 per cent in gross and 13.83 per cent in net over the preceding year. The figures given for 1923 do not include certain large companies which were acquired during the year, but which actually did not become part of the corporate structure of the company until December 29. The combined earnings of the company and the full earnings of the acquired companies for the entire year 1923, in comparison with 1922, show gross earnings of $18,869,140 as against $17,088,868 and net earnings, exclusive of depreciation, of $8,321,943 as against $7,434,259.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

H. H. Jones New Vice-President of Northern States Power

H. H. Jones, recently appointed vice-president in charge of operation of the Northern States Power Company, has been president and general manager of the San Diego Consolidated Gas & Electric Company for the past thirteen years. Born in Reading, Pa., and graduated from Lehigh University, Mr. Jones spent many years with steam and electric railways before becoming general superintendent of the Springfield (Ill.) Consolidated Railway Company, covering supervision of the electric, gas and street-railway departments. In 1909 he entered the service of H. M. Byllesby & Company as manager of the Sandpoint division of the Northern Idaho & Mountain Power Company, now known as the Mountain States Power Company. After one year at the Sandpoint division he was transferred to the position which he held at the time of his recent appointment. Mr. Jones participated actively in the civic and commercial life of San Diego, where he is a member of many clubs and organizations.

H. H. JONES

Edward G. Miner, president of the Pfaudler Company, Rochester, N. Y., was recently elected a vice-president of the Rochester Gas & Electric Corporation.

Charles O'Brien Murphy, formerly vice-president and general manager of the Merchants' Heat & Light Company, Indianapolis, has joined the Electric Bond & Share Company organization. He is now on his way to Cuba, where he will be connected with the Compañia Cubana de Electricidad, a subsidiary of the American & Foreign Power Company, Inc. For the last few years Mr. Murphy has been engaged in organizing and merging utility companies in Indiana for the Brewer interests, holding in addition to his position with the Merchants' Heat & Light Company the vice-presidency and general managership of several of their other properties. He was formerly affiliated with the United Light & Power Company, San Francisco, and when it was merged into the Great Western Power Company he was retained in an executive capacity. Before entering the public utility field Mr. Murphy was connected with stock and bond houses in New York City.

Herbert B. Flowers, president of New Orleans Public Service, Inc., has been elected chairman of the Louisiana-Mississippi Committee on Public Utility Information.

William G. Kerckhoff, president of the San Joaquin Light & Power Corporation and of the Southern California Gas Company, sailed for Europe on board the *Reliance* of the United American Lines on Tuesday, April 29.

Dr. George Klingenberg, director of the General Electric Company of Berlin, left New York for Germany on Tuesday, April 29, aboard the steamship *Reliance* of the United American Lines, after spending a month in the United States studying American power transmission methods.

M. H. Frank, manager of the Wisconsin Power & Light Company's Fond du Lac properties, was elected chairman of the Electric Section of the Wisconsin Utilities Association at its recent convention. Mr. Frank has been identified with the Fond du Lac properties since 1918 and has been actively engaged in utility association work during that period.

Owen D. Young, chairman of the board of directors of the General Electric Company, returned from Europe on Monday, April 28, aboard the United States liner *Leviathan* after spending several months abroad as a member of the experts' commission on German reparations. When interviewed Mr. Young spoke briefly of the complex problem the European situation presents, stressing the importance of the United States as a disinterested nation in the matter of foreign reparations.

Prof. Elihu Thomson, one of the founders of the General Electric Company, sailed April 26 on the *Conte Verdi* for a three months' tour of European countries. While abroad he will receive the Lord Kelvin gold medal, which was recently awarded to him. The presentation will be made early in June at London, England. This award, made through joint action of British and American engineering societies, is made every three years for excellence in engineering research work. Professor Thomson is the first American to receive the honor.

H. W. Fuller Chief Engineer of Byllesby Organization

H. W. Fuller, who has been appointed chief engineer of the Byllesby Engineering & Management Corporation, as was announced in the April 26 issue of the ELECTRICAL WORLD, has been identified with the electrical industry since 1891, the year in which he was graduated from Rutgers College, New Brunswick, N. J. His first work was in connection with the electrification of the horse-car lines at Paterson, N. J., where he remained two years. Subsequently, after a short period of service with the General Electric Company, he joined the Consolidated Traction Company of Newark, continuing with its successor, the Northern New Jersey Street Railway, until 1901, when he became general manager of the Washington Railway & Electric Company and the Potomac Electric Power Company. In 1911 Mr. Fuller affiliated himself with the Byllesby organization, with which he has maintained a continuous association since that date. During that period he has been vice-president and general manager of the Appalachian Power Company, Bluefield, W. Va., vice-president of the Louisville Gas & Electric Company, and in the Chicago office of the organization from 1913 to 1918, when he was made vice-president in charge of operation of the Northern States Power Company. This post he filled until his recent appointment to the Byllesby staff.

H. W. FULLER

William M. Black, since 1919 chief engineer of the Maine Public Utilities Commission, has resigned, effective May 10, to become electrical engineer of the Pennsylvania Public Service Commission and will take up his new duties about May 19. Mr. Black is a native of Belfast, Me., and was graduated in 1909 in civil engineering from the University of Maine. After doing cost accounting work for Frank B. Gilbreth, efficiency engineer, New York, he engaged in designing work with a number of structural-steel companies, later being employed on subway construction in New York City. With the Maine commission Mr. Black has

Commission Rulings

Discrimination Between Different Groups of Rural Customers Forbidden.—The rural schedule of the Tualatin Valley Electric Company has been disapproved by the Public Service Commission of Oregon as discriminatory in that it imposed a higher minimum charge on new than on old consumers. In an order providing for rural and other extensions the commission had provided for a minimum investment of $60 per customer, or at least two and one-half times the expected revenue. The respondent company contended that where there was a small amount of rural business in comparison with the city business this minimum requirement might be carried by the utility, but where there was a large amount of potential rural business the minimum expenditure prescribed pointed toward ruin, if no more than approximately city rates were to be charged. A minimum charge of $2 was therefore proposed. The company further contended that the discrimination proposed as between old and new customers was justified on the ground of increased costs of construction. Analysis of the exhibits and testimony presented by the respondents clearly indicated, the commission said, that the differential sought was not justified on that basis. Analysis of the present operating costs showed that the existing rural customers have been carried at a loss. It also showed that the city rates do not justify a free expenditure of $60 by the respondents. It indicated that a minimum charge of $1.50 may be reasonably required of all rural customers, and this charge was ordered.

Meaning of "Present-Day Valuation."—In fixing rates for the Monroe Gas Light & Fuel Company in the city of Monroe, the Michigan Public Utilities Commission said: "The term 'present-day valuation' has been variously defined by the courts. Generally speaking, it implies the valuation as of the time when the utility is using its property for and in the public service, and when called upon to fix a valuaton we do so as of the present time, in order to eliminate obsolete value or values that by reason of changes in standards can no longer be considered as governing. We do not understand, however, that we are required to apply prices as of a particular day, nor should we consider price fluctuations from day to day. . . . Two methods are open to us in determining property values based upon reproduction cost new, namely, first, theoretically to rebuild the plant as of the present time, and, second, to take the property as and when installed, appreciate the value of such components as have appreciated in value, and then deduct for depreciation, including wear and tear, obsolescence, decay and other depreciating factors. We think the first method is altogether too speculative. The appraisal made by the Baehr Corporation in this case is practically based upon a theoretical reproduction of the plant. The same thing is true of the commission's engineers' first appraisal, and to a lesser degree of their reappraisal. This method involves theories as to the cost of material and labor in construction and further theories as to overheads and undistributed costs, and neglects the element of actual experience such as competitive construction. We do not say that this method is not useful as a check upon other methods, but we do not believe that it can be employed satisfactorily for any other purpose so long as other methods are available. The second method is much more practical and less speculative."

Recent Court Decisions

Federal Government Amenable to Change Made by Commission in Contract Rates.—In the case of the United States of America vs. Oklahoma Gas & Electric Company, the United States Circuit Court of Appeals in Oklahoma has upheld the action of the Corporation Commission in overruling a contract and fixing higher rates for electricity furnished by the company to the Fort Reno remount depot operated by the United States War Department. The decision says that "there was no reason why as to a contract of this nature the government should occupy any different position than if the contract had been made between two of its citizens."

Damages Awarded Because Supply of Energy to Pumping Station Was Shut Off During Fire.—A verdict of $47,703 has been returned by a jury in the Rock County Circuit Court in Wisconsin in favor of the Edgerton Highway Trailer Company in a damage suit against the Janesville Electric Company which has been in the courts since 1921. (See ELECTRICAL WORLD, December 23, 1922, page 1411.) The trailer company sued for damages amounting to $250,000 because of alleged negligence on the part of the Janesville Electric Company when it shut off the supply of energy to the Edgerton pumping station at the time the fire department was combating flames at the plant. The plaintiff claimed that the interruption in operating the pumps aided the progress of the flames. The case once went to the Wisconsin Supreme Court on demurrer proceedings and was ordered back for trial with rulings that the Edgerton company could not recover on the grounds of a breach of contract but only on the issue of negligent interference by the power company at the time of the fire. The verdict, however, holds that both the parties in the suit were negligent in the matter of electrical equipment and installation. The power company was condemned for failure to provide a pole-top switch or other device for disconnecting the line to the trailer plant without interrupting the current to the pumping station, and in addition for failing to exercise ordinary care in restoring the power to the pumps after the interruption, while the plaintiff was blamed for not having the proper safety devices in its plant, although the absence of these installations was not considered instrumental in causing the interruption of supply. The defense contended that a short circuit from within the burning plant caused the circuit breaker automatically to shut off the power from the transmission line.

Company Held Responsible for Injury from Tripping Over Unguarded Guy Wire.—The Oklahoma Supreme Court has affirmed a decision of the lower court granting judgment to Lutie Griffith against the Shawnee Gas & Electric Company, where the plaintiff claimed damages for injuries caused by falling over a guy wire on a dark night. The court held it was an error to permit a qualified construction engineer to express his opinion as to whether the method of anchorage used was improper. The court also held that, while the company had a right to anchor its pole between the sidewalk and the curbing, the plaintiff also had a right to cross this space to enter her carriage. It was the duty of the company to exercise reasonable care for the safety of persons passing that way, and the company should employ some well-recognized method of guarding its wire. The plaintiff was required to exercise only ordinary care, and the question of contributory negligence was one of fact for the jury's sole determination.

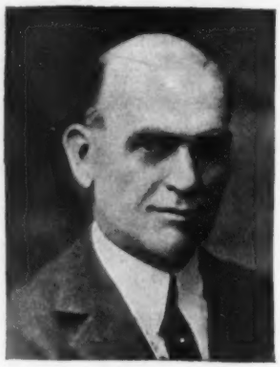
Municipal Contract Controls in Florida Until Legislature Acts.—In 1914 the city of Palatka, Fla., entered into a contract with the Palatka Gas, Light & Fuel Company under which the latter (later absorbed by the Southern Utilities Company) built a plant in Palatka and agreed to charge domestic consumers 10 cents a kilowatt-hour. This rate was raised by the Southern Utilities Company to 13 cents on the ground that the lower rate was confiscatory, and the city obtained an injunction against the increased charge, which has been confirmed by the Supreme Court of Florida (Southern Utilities Companv vs. City of Palatka). The court, maintaining the police power inherent in the State Legislature to raise the rate at any time, says that the city of Palatka has not been authorized by statute to regulate rates for electricity furnished by a public utility company to the city and its inhabitants, but that the general statutory powers are sufficient to confer upon the city authority to make a franchise contract with provisions as to rates to be charged individuals for electric lights. Such contract is consistent with the express power "to provide for the lighting of streets of the city" and is not repugnant to or inconsistent with any specific or general statutory power of the city. The question as to whether the contract rates are remunerative is immaterial, and the contract controls until the Legislature acts in the premises. (This case is to be reviewed by the United States Supreme Court.) (99 So. 236.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

specialized in valuation and service investigation activities and has been much occupied with public utility safety engineering problems.

S. A. Redding Returns from South America

S. A. Redding, who has been engaged in consulting and construction engineering work with headquarters in Rio de Janeiro, Brazil, has recently returned to the United States after an absence of five years. It was at the end of 1919 that Mr. Redding arrived in Rio, where he established himself as a consulting engineer, serving also as engineer representative of American manufacturers. Before leaving for the tropics he had been for sixteen years



S. A. REDDING

associated with the Georgia Railway & Electric Company and its successor, the Georgia Railway & Power Company, as assistant electrical engineer, electrical engineer and general superintendent of the electrical department. Mr. Redding had previously spent a period of five years in South America, covering the years 1898-1903, when he was identified with the Manaos (Brazil) Electric Light Company for one year and with the Manaos Railway for four years, both of these concessions being owned at that time by Charles R. Flint & Company of New York.

Mr. Redding was graduated from the Alabama Polytechnic Institute at Auburn in 1894 and promptly entered the employ of the Georgia Electric Light Company in the capacity of electrician. Following a short connection with the American Telephone & Telegraph Company he affiliated himself with the Schenectady works of the General Electric Company, engaging in telephone maintenance and general test work. From there he was sent to Brazil, as already stated, for Charles R. Flint. Mr. Redding has not as yet completed plans for the future.

Frank G. Horton has been made assistant secretary of the Illuminating Engineering Society, succeeding the late Dr. Ralph Chapman Rodgers. Mr. Horton, a native of Massachusetts, has a record of twelve years' experience in power plant operation, line construction, equipment testing, accounting, sales and commercial office management. Since 1920 Mr. Horton has been associated with the Electrical Testing Laboratories, where he has been engaged in making statistical analyses in connection with the surveys of residence lighting equipment conducted by the Association of Edison Illuminating Companies during the three years just past.

Brig.-Gen. Harry Taylor, now assistant chief of engineers, has been selected by Secretary Weeks to fill the vacancy which will be caused by the retirement on June 18 of Major-General Lansing H. Beach as chief of the Corps of Engineers. He will have the rank of major-general.

Colonel Edgar Jadwin, who is now district engineer at Charleston, S. C., will succeed Brigadier-General Taylor as assistant chief of engineers. He will be promoted to the rank of brigadier-general. Colonel Jadwin was recently designated as an adviser on the board of engineers to consider the St. Lawrence waterways project.

E. W. Allen, formerly engineer and assistant manager of the central district of the General Electric Company with headquarters at Chicago, has been appointed manager of the engineering department of that company, according to a recent announcement by Francis C. Pratt, vice-president in charge of engineering. Mr. Allen first entered the employ of the General Electric Company in 1901 in the test department in Schenectady. One year later he was assigned to the lighting engineering department, where he remained until 1911, when he was appointed engineer of the Chicago district. Subsequently Mr. Allen was made assistant district manager in addition to his duties as district engineer. Mr. Allen is a native of Virginia and a graduate of the Virginia Polytechnic Institute.

A. F. Riggs has been appointed engineer of the central district of the General Electric Company with headquarters in Chicago. Mr. Riggs is succeeding E. W. Allen, recently made manager of the company's engineering department.

J. G. Nelms, formerly of the Georgia Railway & Power Company, Atlanta branch, has been transferred to Gainesville and given the commercial superintendency of the company's office there.

Oscar B. Smith of Knox, Ind., has been appointed a member of the Indiana Public Service Commission to succeed Oscar Ratts of Paoli, whose term has expired. Mr. Smith is one of the leading attorneys of northern Indiana, having practiced law for more than twenty years, and is a former member of the State Senate, where he represented his own and another county.

J. R. Abercrombie, who was secretary-treasurer of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, has been made secretary-treasurer of the Capital Gas & Electric Company, Topeka, Kan., formerly known as the Consumers' Light, Heat & Power Company. Mr. Abercrombie had been connected with the St. Joseph property for twenty-two years.

J. F. Owens Heads N.E.L.A. Southwestern Division

James F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company since 1918, was elected president of the Southwestern Geographic Division of the National Electric Light Association at its recent convention in New Orleans. Mr. Owens, though an exceedingly busy man, as his innumerable connections with commercial and civic enterprises indicate, has never failed to give special attention to the activities of the Southwestern association. A native of Illinois and a graduate of Kansas State University, he entered the public utility field in 1905, when he became associated with the Baldwin (Kan.) Gas Com-

J. F. OWENS

pany, advancing later to the office of manager of this organization. Subsequently he became manager of the gas company at Wagoner, Okla., but in 1910 affiliated himself with the Muskogee Gas & Electric Company, rising to the position of manager by 1917. One year later Mr. Owens was selected to fill his present office. Mr. Owens is preeminently a man who establishes organization morale and fitness through his personal interest in employees, building on this foundation an enviable record in the way of public relations.

Obituary

Alfred Cotton, chief research engineer of the Heine Boiler Company, died at his home in St. Louis on Thursday, April 17. A Briton by birth, Mr. Cotton came to America in 1903 and developed the Cotton furnace, which embodied a high-efficiency system of steam-jet forced draft. He manufactured and installed these furnaces and applied apparatus until the war, when he entered the employ of the Colt's Patent Fire Arms Manufacturing Company, subsequently becoming chief engineer in the combustion department of the Sterling Blower Company. Five years ago Mr. Cotton went to St. Louis as research engineer of the Heine Boiler Company. He was fifty-three years of age.

could and should strengthen his window displays, his store displays and appearance, his personal lamp selling in the store and his outside selling efforts. The whole picture was put before him in what was called a "four-star campaign," one star representing each of these elements in his selling effort.

A TEST OF INFLUENCE

Finally, after this idea had been promoted for two years, a systematic effort was made to ascertain by checking up a list of four thousand lamp agents exactly what influence had been exerted on their selling methods. The result is shown in the accompanying diagram. In a word, it shows that in 1923, with the policy of selling these dealer helps well established and the retailers participating in their cost and therefore more careful in their use, the percentage of dealers actively promoting their business by the use of enlightened methods was very considerably increased. The number using outside electric signs, the number actively using their windows to advertise their goods, the number with well-lighted windows and stores, with lamp stocks well placed, and those who demonstrated lamps and used lamp advertising in their stores and went outside their stores to sell lamps, were much greater, as is indicated.

So much for results from the manufacturer's viewpoint. But what does the dealer think of it? The following letter from a Middle West electric dealer is interesting:

We believe that when the dealer shares a proportion of the cost of the advertising material used much more satisfactory results are obtained from the advertising for various reasons, which we wish to enumerate as follows:

1. The dealer takes much more interest in the advertising and thereby derives many more benefits therefrom.

2. The dealer as well as the manufacturer obtains better ultimate results from this type of advertising on account of the fact that a better class of advertising can be used.

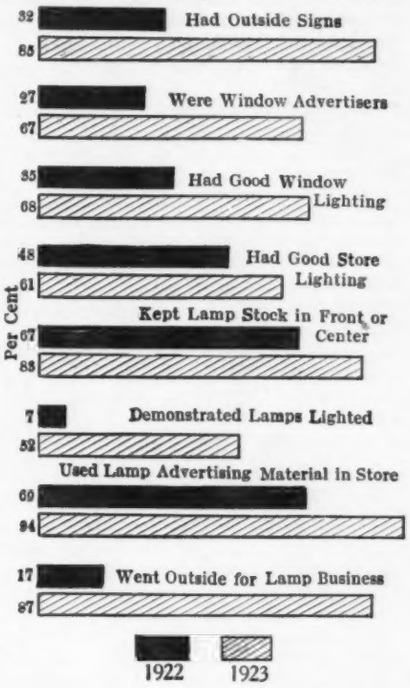
3. This method of advertising eliminates the illegitimate, unfair dealer and prevents unfair competition on account of the fact that this class of dealer will not pay the price.

4. The fact that the dealer is expected to pay part of this advertising, as before mentioned, eliminates waste, which very largely reduces the manufacturer's cost.

Our experience with this type of advertising has been very satisfactory. We are firm believers in the co-operative dealer-help program in advertising. We have often thought of the cost of the veritable avalanche of advertising folders and the like which were sent out by manufacturers, only to be placed on a dealer's shelf, because they cost nothing, and eventually to find their way to the scrap heap or to the furnace. These advertising helps, if they had been properly used and properly appreciated, would have brought big returns to both the dealer and the manufacturer.

Another dealer in another state adds this:

The best way to tell what we think of the co-operative advertising helps, for which we pay part of the cost, is



INFLUENCE OF JOINT RESPONSIBILITY IN DEALER ADVERTISING

to submit the following list of co-operative dealer helps which we are now using:

"Lamp Demonstrator."
"Window Display Service."
"Outdoor Blue Carton Lantern."
"Match Folders."
"Dealer Calendar."
"Glassware Display Rack."
"Auto-Lamp Stock Cabinet."

Besides the helps listed above, we have made contracts with two manufacturers for newspaper advertising whereby they pay 50 per cent of the cost of our "ads" in which their goods are featured. These contracts will enable us to spend nearly 1 per cent of our gross sales on advertising, which we would not otherwise be justified in spending. Aside from this we have a regular newspaper advertising program. This method ties in with the national advertising and is sure to bring the desired results.

We are so thoroughly sold on the co-operative advertising that it is almost a certainty that if the National Mazda people bring out a new co-operative proposition we shall accept it readily. We have tried everything they have offered, sometimes with misgivings as to the outcome, and have found it to our advantage each time.

Does it pay? Our reports for the past twelve months show that our lamp sales have increased 105 per cent over the twelve-month period previous to August 1, 1921, when we signed our contract and started to use these advertising aids. A large part of this increase is due directly to the lamp demonstrator, the window service and the blue lantern.

Circulars, if properly used, are a good advertising medium, but the tendency on our part is to let them accumulate until they become a nuisance, and then they usually find their way to the wastebasket. However, the co-operative "ads"—for instance, the calendars—are not thrown away, because they cost us something. When we spend our own money as well as that of others, we see that it is put where it will bring us the largest return. If a manufacturer offers us co-operative advertising aids, we figure this as an additional 1 per cent of gross profit on his products.

These letters are quite typical of the opinions that are expressed by the lamp agents who have accepted this plan. This is confirmed in an interesting way by a jobber who has been instrumental in developing many converts to the plan among his agents. Speaking of five dealers of different size who, among many others, have been benefited, he says:

None of these agents used co-operative advertising before we took them on, and many of them were very skeptical about the proposition when our first piece of co-operative material was introduced. Every one of them has advanced his basis of contract—in spite of the fact that several have only just signed their second contract with us. Three of these agents have advanced one step since using co-operative material, two of them have advanced two steps, and two of them have advanced three steps higher on their basis of contract. The agents are all good enough business men to know that it is not all due to their own efforts and give credit to the class and quality of this advertising.

We are thoroughly sold on the proposition. I do not mean to say that it is always easy to sell co-operative advertising to an agent, but we have found in many cases that the more skeptical an agent is in spending his good money for our advertising, the bigger booster he is after the results are shown.

There is just one more point that I would like to mention, and that is the tendency that the co-operative plan has to make a more personal "tie-up" between the jobber and the dealer. There seems to be a feeling among the dealers using this plan that they are really standing part of the expense for putting over a big nationally advertised product, and they take pride in seeing National Mazda advertisements in the big magazines when they feel that they are a part of a well-organized plan and that they are doing their share to put the product before the public. We believe that the co-operative plan should be credited with no small portion of whatever success we have had in accomplishing these results.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Saving Waste on Dealer-Help Advertising

An Interesting Experience Developing the Sale of Manufacturers' Publicity Matter and Teaching the Dealer to Use It More Effectively

A VERY interesting evolution is taking place in the policies of several prominent electrical manufacturers who advertise extensively. In a word, they are generally getting away from the practice of furnishing free dealer-help advertising materials and have begun to sell them—a very radical change.

There was a time when retail dealers in all fields bought goods and sold them by their own unaided efforts. The manufacturers' selling function ceased when they sold their produce to the wholesaler or the retailer. The wholesaler sold to the dealer and let it go at that. All this was before the advent of national advertising. But as soon as manufacturers began to advertise broadly to create consumer interest and demand the whole situation changed. Competition in advertising became as keen as competition in selling. The offering of publicity and advertising material became a very prominent feature of selling. And this practice has been carried to such lengths in the last few years that it has become an insufferable cause of waste and in many ways exerts a bad influence upon the dealer himself.

Waste of Printed Matter

The dealer needs advertising. But the value of it lies not in its possession but in its use. Therefore anything that stimulates the dealer to a better selection and a more intelligent application of advertising material increases his sales. But the ease with which he has been able to procure all kinds of expensive dealer-help advertising in recent years has not stimulated him to efficiency. It has been a case of "easy come, easy go." The retailer has grown to expect that he will be provided with large quantities of expensive materials without recognition of any particular responsibility to utilize them economically. And this has led to a tremendous amount of waste — through the ordering of folders, blotters and other literature in too great quantity, through asking for materials that are not appropriate for that particular dealer's use, through the accumulation of too much advertising matter in the dealer's stockroom, and through the careless neglect of the whole subject because it represented no expense and was too often looked upon as a nuisance owing to the trouble of sending the literature out. But try as the manufacturer will to cut down the quantities called for, the stress of competition and the rising cost of printed matter have forced the outlay for dealer-help advertising to a point where it has become a tremendous burden of expense on the industry.

Trying It on Lamps

To ascertain how far it might be possible to overcome this situation, the National Lamp Works of the General Electric Company began four years ago to introduce into its dealer-help advertising special feature articles that were offered not free but for sale. In support of this innovation it was represented to the dealer that, since the manufacturer must work within his budget, no matter how large his advertising appropriation might be, the tendency of the time was forcing him to quantity rather than quality in the production of dealer-help materials. Naturally it was necessary for him to stick to usual varieties of materials that could be turned out in large volume at a minimum price. It was impossible to develop certain desirable special features even though these would be helpful to the dealer in selling lamps, because they would be too expensive for general distribution on the usual profligate scale. So, to demonstrate the desirability of such a super-advertising service, the National Lamp Works proceeded to develop special dealer helps such as window-trim background screens with seasonable monthly poster fillers, a metal and glass lantern for the front of the dealer's store, a lamp demonstration fixture for the counter, demonstration equipment, and so on. This material was offered to dealers at a price that covered the manufacturer's cost.

Dealers First Opposed

The first reaction from the lamp agents was naturally hesitant. But the idea was sold to them systematically, a careful effort being made to convert each dealer to the philosophy of effective utilization of advertising matter and to show him what his own needs were. Gradually the principle has been applied to other more commonly used material as well, and special folders, blotters, wall hangers, complete mail campaigns, price tags and the like have been produced in a quality not practicable on the give-away basis. Some dealers refused to pay. Why should they buy what competitors were giving away, they asked. Branch offices protested, claiming that the cost of selling these materials would be as great as that of giving them away. But time demonstrated the soundness of the principle involved and that the policy is practical—if the quality is put into the material. Some jobbers objected, started to buy this material and continued to give it away.

But within two years they discontinued this unnecessary expense, for they saw that the sale of dealer-help advertising matter was tending to develop the kind of material that the dealer wanted and that he was becoming more interested in expressing his needs and getting bigger results from the more careful use of better advertising. Incidentally this movement seemed to offer the manufacturer a basis for a more purposeful presentation of the whole subject of advertising, and an organized effort was made to interpret the dealer's advertising needs along broad lines and show him how he

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ANNOUNCEMENTS by three of the largest electrical manufacturers of the status of their business for the first quarter of the year show the excellent condition of the industry. Westinghouse billings were larger than last year. Bookings were somewhat less, although they were more than for the preceding three months. Western Electric billings were reported larger than last year by $16,000,000, and orders on hand are nearly $13,000,000 more than for the same period last year. Otis Elevator reported orders amounting to $30,000,000 now on the books. Meanwhile announcements of extensions and building expansion by electrical manufacturers hold a prominent place in the industry news. All this bespeaks confidence and good health in the electrical business, despite the admitted fact that the general market has been quieter for some time. Copper wire has fallen off slightly, in tune with the metal markets, but the general price situation is unchanged.

Business in the New England section is reported spotty, but with good demand—particularly central-station and municipal buying. About New York the volume has been good and building lines are most active. The week has been rather slow in the Southeastern States. Telephone equipment, street-lighting equipment and poles, however, are in good demand. Keen competition and steady buying is reported through the Middle West. What is probably one of the largest single orders for radio tubes and battery chargers was taken by one company this week. The market continues quiet on the Pacific Coast, although the sales of small household supplies, such as bells, push-buttons, etc., are reported running 30 per cent better than last year.

Inclosed Circuit Breaker in Heavy Demand

THE demand for the inclosed type of air circuit breaker, which first originated through a ruling of a local board of fire underwriters, according to one manufacturer now reaches a volume that is 25 per cent of his total sales and is constantly increasing. Sales during 1923 are reported by the same company as double those of 1921 and 1922 added together. There is generally reported a better sale of small inclosed breakers for industrial-plant service owing to the nation-wide interest in safety engineering. It is expected that factories will be busy throughout the year in the effort to keep up with present and anticipated business. Another manufacturer also reports that he sells a number of ordinary circuit breakers to customers who supply their own inclosing structures.

Deliveries run from one week to three weeks, there being practically no accumulation of stocks of finished articles, owing in a large measure to the demand and also to the variety of sizes. Shipments of another house are running well above the factory output of a year ago, although the volume of orders received in the last few weeks has shown a tendency to remain steady. However, at this season there is usually a slight lull in the demand compared with the volume of business obtained in early winter, but the pace is expected to quicken within the next few weeks.

The supply of raw material is plentiful, with the possible exception of slate in some cases, while labor for the time being is plentiful and available in sufficient numbers and quality to meet present needs. One company stated that 90 per cent of the deliveries of all types of circuit breakers could be made in three weeks were it not for slate. With 1-in., 1½-in. and 2-in. slate no real difficulty is experienced but thicker slates required in the larger and special jobs, are very hard to get. Prices are steady, and they are, moreover, expected to remain so.

Australia Manufacturing Large Turbo-Generators and Cables

THE manufacture of electrical generating apparatus and telephone and telegraph cables was added to the list of established industries in Australia during 1923, according to Consul N. L. Anderson's report to the Department of Commerce. A company in New South Wales has been engaged in making an 18,750-kw. turbo-alternator and is beginning to work upon another machine of the same size. This is the first undertaking of this magnitude in Australia covering this class of machinery.

Another firm in Victoria is building steam turbines of a large size. A factory in New South Wales has been equipped to manufacture telephone and telegraph cables, and for the first time the Postal Department is obtaining cables from Australian manufacturers.

Foreign Situation Causes Metal Prices to Trend Downward

OWING principally to forced selling in Europe, all metal prices have exhibited a downward trend during the last week. The last three days, coming at the end of the month, have aggravated the condition.

Brass and wire manufacturers were very active buyers of copper on Thursday and Friday last week. A wide range of prices was evident at that time, ranging from 13⅝ cents to 13⅝

VALUE OF ELECTRICAL EXPORTS FOR MARCH, 1924, COMPARED WITH CORRESPONDING MONTH IN 1923

	March	
	1923	1924
Generators:		
Direct-current:		
Under 500 kw.	$68,630	$111,435
500 kw. and over	91,249	81,816
Alternating-current:		
Under 2,000 kva.	10,960	3,860
2,000 kva. and over	131,022	186,426
Steam-turbine generator sets	*	4,690
Accessories and parts for generators	38,695	66,042
Self-contained lighting outfits	57,514	35,557
Batteries:		
Flashlight	*	69,002
Other primary	123,388	63,610
Storage	176,669	362,583
Power transformers	362,707	502,085
Other transformers	59,167	256,669
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	250,844	44,606
Switchboard panels, except telephones	138,413	244,546
Switches and circuit breakers over 10 amp.	166,180	140,148
Fuses and fuse blocks	21,551	23,404
Watt-hour and other measuring meters	49,022	40,431
Volt, watt and ampere meters and other recording, indicating and testing apparatus	103,706	91,679
Lightning arresters, choke coils, reactors and other prospective devices	42,254	78,489
Motors under 1 hp.	128,276	132,498
Stationary motors:		
1 hp. to 200 hp.	254,463	339,033
Over 200 hp.	28,487	161,141
Railway motors		176,268
Electric locomotives:		*
Railway	474,098	20,938
Mining and industrial	18,780	12,684
Other motors	13,183	†
Starting and controlling equipment:		
Industrial motors	*	124,823
Electric railway and vehicle		17,290
Rheostats, controllers and other starting and controlling equipment	137,373	†
Accessories and parts for motors	112,508	217,678
Electric fans	156,904	135,037
Electric lamps:		
Incandescent—		
Carbon-filament	3,471	4,777
Metal-filament	117,466	98,862
Other electric lamps	$19,027	$14,667
Flashlights	43,284	56,335
Searchlights and projectors	14,641	36,043
Motor-driven household devices	71,710	75,490
Domestic heating and cooking devices	97,567	116,466
Industrial electric furnaces and ovens	13,719	15,088
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	64,680	89,516
Radio and wireless apparatus	213,094	288,812
Telegraph apparatus	16,643	13,739
Magneto telephones	7,399	5,509
Other telephones	31,327	49,194
Magneto switchboards	2,964	953
Other telephone switchboards	34,718	233,851
Other telephone equipment	*	154,491
Railway signals, switches and attachments	33,623	95,953
Bells, buzzers, annunciators and alarms	12,582	7,901
Spark plugs, magnetos and other ignition apparatus	111,978	146,404
Insulating material	129,986	128,721
Metal conduit, outlet and switchboxes	51,784	36,657
Sockets, receptacles and lighting switches	90,848	117,163
Other wiring supplies and fixtures	204,647	†
Electric lighting fixtures, interior and street	*	42,214
Other wiring supplies and line material	*	114,307
Other electrical apparatus, not elsewhere specified	648,034	772,770
Globes and shades for lighting fixtures	39,561	37,931
Electrical glassware, except for lighting	24,301	20,343
Electrical porcelain	169,662	227,713
Electrical carbons, carbon brushes, electrodes	184,956	256,795
Insulated wire and cable (iron and steel)	83,103	33,461
Other manufactures of aluminum	66,092	125,663
Copper:		
Bare wire	110,033	113,736
Insulated wires and cables	408,374	288,472
Total electrical machinery and apparatus and supplies	$6,337,317	$7,564,465

* Not separately stated prior to January, 1924. † Discontinued beginning January 1, 1924.

NEW YORK METAL MARKET PRICES

	April 23, 1924 Cents per Pound	April 30, 1924 Cents per Pound
Copper, electrolytic	13½	13.30
Lead, Am. S. & R. price	7.90–8.25	8.0
Antimony	9½–10	9½
Nickel, ingot	27	27
Zinc, spot	6½	6½
Tin, straits	49¼	47¼
Aluminum, 98 to 99 per cent	28–29	28

cents, with most of the large producers selling at 13½ cents. The foreign situation early this week caused prices to drop to as low as 13¼ cents, at which price a few sellers are willing to accept business. The official contract price of the American Smelting & Refining Company for lead was reduced to 8 cents last week. Most of the metal has been sold on contract at fixed prices. Good sales of zinc were made during the week, but at sacrificial prices.

Delinquent Electrical Accounts Show Improvement

ALTHOUGH four of the five territories reporting to the National Electrical Credit Association show a gain in the number of delinquent accounts, for March, 1924, over the previous month, the number of accounts reported, together with the average amount, is much lower than for the same period last year.

DELINQUENT ACCOUNTS IN MARCH

Branch and Month	Number of Accounts Reported	Total Amount	Average Amount
Central Division:			
Feb., 1923	635	$69,996.47	$107.49
Feb., 1924	821	89,621.45	109.16
Mar., 1923	993	130,571.90	131.49
Mar., 1924	941	99,989.14	106.26
New York:			
Feb., 1923	283	36,045.00	127.00
Feb., 1924	365	54,688.00	150.00
Mar., 1923	584	73,655.00	126.00
Mar., 1924	445	68,022.00	153.00
Philadelphia:			
Feb., 1923	176	26,881.67	152.73
Feb., 1924	258	31,823.03	123.35
Mar., 1923	204	26,386.27	129.34
Mar., 1924	233	26,163.85	112.29
New England:			
Feb., 1923	48	2,495.35	51.99
Feb., 1924	33	4,789.14	145.12
Mar., 1923	60	4,782.71	79.71
Mar., 1924	46	4,708.60	120.36
Pacific Coast:			
Feb., 1923	15	4,245.63	283.04
Feb., 1924	9	1,072.04	119.11
Mar., 1923	48	7,522.26	156.92
Mar., 1924	12	1,175.31	97.94

Good Volume of Business in New York District

REPORTS from manufacturers and jobbers indicate that there is a good volume of business being transacted in the New York district. The many quotations requested by central-station companies forecast activity. Industrial buying, however, continues light from both the manufacturer and the jobber.

Many central-station budgets which have been approved for next year are encouragingly large. These purchases, however, are expected to be almost completely for secondary apparatus. Present central-station buying is in good volume, although it is less than the very high rate established during the last twelve months. Railways are now in the market for equipment the purchase of which has long been delayed, so that railway business can be considered normal and expected to remain so.

Jobbers report that building supply lines are moving best owing to the large amount of construction now under way. Appliances are not selling very rapidly, although some good sales are reported. Quick shipments are still being maintained by manufacturers, and buying by all sources remains conservative. Rubber-covered wire has suffered a slight decline in prices varying from 2 to 5 per cent. Jobbers are looking forward to a good fan season.

New England Sales Are Spotty—Good Demand for Line Supplies

UNEVEN demands for electrical material, fair buying by metal-working industries and municipalities, with steady sales of line supplies to central stations and generally complete stocks, characterize this week's market in New England. Conditions are admittedly spotty, and from all quarters dissatisfaction is voiced as to political conditions, which are depressing business.

Regardless of politics, however, the growth of the central-station industry continues. This means a steady volume of new business for the jobber and the manufacturer. Municipalities are actively buying supplies for departmental use, one order in Boston last week for school and fire department battery, annunciator and allied equipment totaling $12,000. Street-lighting improvements are well under way in many places, even though on a small scale. Appliance sales are fairly good and electric ranges are moving well. Rubber-covered wire has weakened about 5 per cent in large sizes to 2 per cent in small sizes. Collections are fair.

Retail Sales Slowing Up in Southeast District

THE volume of retail sales during the past week has been somewhat disappointing, but this slowing up is not peculiar to the electrical business alone, being noticeable throughout the entire retail trade. Interest in industrial construction is reviving somewhat, the textile mills apparently taking advantage of the quiet period to consider improvements and expansions to plants.

Jobbers are reporting an excellent movement of fans, probably the best in two years, with the season's prospect bright. The amount of large office building and commercial building construction is reflected in a brisk demand for ceiling fans, and the movement of small ventilating fans is very good. Street-lighting equipment, particularly of the "white-way" type, is in good demand, though parkway cable is reported as slow. Lamps are maintaining the usual seasonal volume, stimulated somewhat by the good results obtained by kitchen-lighting unit campaigns put on by the larger Southeastern central stations. Other companies are planning similar campaigns.

The demand for telephone equipment is excellent, with orders coming from both the large and the small companies, but shipments are slow. Sales of poles and cross-arms are reported very good with an unusual number of inquiries during the past ten days. Shipments on chestnut poles are at thirty days, but on creosote poles they are somewhat longer.

Electrical Buying Steady in Middle West—Competition Keen

BUSINESS in electrical products in the Middle West is still running fairly strong and well above a month ago. Merchandise is being absorbed in considerable quantities by consumers, but there is little forward buying and price competition is still keen. Utilities are buying secondary equipment and maintenance material mostly, although one manufacturer reports receiving a sizable order this week for rectifier equipment. The demand for pole-line hardware has been a little better this week than last, and there has been quite an active demand for fiber conduit in line with the spring work of some of the central-station companies.

The week has been particularly free from price fluctuations with the exception of slight reductions in code wire made by one manufacturer which others are expected to follow. Radio sales to the consumer have declined somewhat, although manufacturers of radio equipment are still enjoying volume business. One company reports a single order for 2,700 battery chargers and 5,400 tubes, probably one of the largest orders for this class of material placed since radio became so popular.

Utility Buying Active on Pacific Coast—Retail Trade Slow

ELECTRICAL retail trade on the Pacific Coast has been quiet during the past week except in the case of construction supply lines, which are moving in good volume although orders are of comparatively small size. This is partly the result of an uncertain market and lower quantity discounts. The situation has been materially affected, however, by the business that has developed from power-company expansion programs and industrial construction and maintenance work. A new mining project for north central California, to cost about $25,000,000, and a steel merger reported from the San Francisco Bay district, involving $40,000,000, which will require much electrical construction and maintenance material, are also interesting prospects.

Bare copper wire, stranded guy wire and poles are moving well and good deliveries are being maintained. Railroad business has quieted down. Sales of small household supply lines, such as bells, push-buttons, etc., are running about 30 per cent over those of last year. Fiber, mica and other insulating material are in good demand, no doubt influenced by the peak of the motor irrigation season. Jobbers report many pre-seasonal fan contracts, but the actual seasonal sales may be affected by the fact that the best districts under normal conditions are the areas at present affected by the drought and the cattle epidemic.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Russell Electric Purchases Six-Story Building

The Russell Electric Company, Chicago, has purchased from the Brunswick-Balke-Collender Company the entire block lying between Huron and Superior Streets and Orleans and Sedgewick Streets, containing a six-story building having 425,000 sq.ft. floor space and a plot of ground, 49 ft. x 100 ft., at a cost of more than $1,500,000. According to Thomas C. Russell, president, the reason for this purchase was the remarkable expansion in its line of heating appliances. Although no new products were put out this year, the past four months has seen a big increase in the volume of business over the same period in 1923, the March, 1924, sales being four times those of March, 1923. This new purchase will bring the manufacturing floor space up to about 50,000 sq.ft., which will be gradually increased as the present leases expire.

Harper & Taylor, Inc., a New Engineering Organization

Harper & Taylor, Inc., are a new engineering firm organized with offices at Philadelphia in the Bankers' Trust Building and at Niagara Falls, N. Y. The firm will specialize in the investigation of water powers and the design, construction, operation and management of hydro-electric power projects, although it will also engage in the general practice of engineering.

H. Birchard Taylor is president and John L. Harper vice-president. Henry P. Rust, manager of the Philadelphia office; Norman R. Gibson, manager of the Niagara Falls office; Oliver D. Dales, construction engineer; J. Allen Johnson, electrical engineer, and Louis S. Bernstein, designing engineer, are also associated with the organization.

General Electric Constructing New Building at Philadelphia

Increased business in the manufacture of switchboards is the reason given by the General Electric Company for the construction of a new building at its West Philadelphia plant, which will be occupied about July 15 by a force of eight hundred to one thousand workers. The unit now under construction represents one section of a possible expansion program which was begun a year ago.

A million-volt testing set, similar in design to that recently ordered by the Commonwealth Edison Company of Chicago, will be installed in a specially constructed building in the West Philadelphia extension. This set will be used in connection with the manufacture and testing of high-voltage oil circuit breakers. The company announces that no removal of switchboard development work from Schenectady is contemplated and that the headquarters of the department will remain at Schenectady, where they are at present.

Allis-Chalmers Company Buys Worthington Cudahy Plant

The Allis-Chalmers Manufacturing Company has purchased that portion of the business and machinery of the Worthington Pump & Machinery Corporation's Cudahy (Wis.) plant that was engaged in the production of mining, cement, crushing and creosoting machinery lines. All other lines formerly manufactured at Cudahy will be transferred to other Worthington plants. Plant and real estate were not included in the purchase.

In a statement made by the Worthington company, it is stated that the sale is in line with its policy of concentrating activities on the other products manufactured by the company. To insure service to users of Worthington apparatus everything pertaining to these power and machinery lines have been turned over to the Allis-Chalmers company and will be transfered to its West Allis plant, where the business will be continued in conjunction with similar lines which it has been manufacturing.

Otis Elevator Authorizes Common-Stock Increase

At a meeting of stockholders of the Otis Elevator Company this week an increase in the company's common capital stock from $15,000,000 to $25,000,000 and a change in the par value of the stock from $100 to $50 per share was authorized. It is expected that the directors will soon authorize a 10 per cent stock dividend.

W. D. Baldwin, chairman, told the stockholders that the company had orders on its books amounting to $30,000,000. W. W. Miller was elected a director to succeed George H. Fenson and other directors were re-elected.

Westinghouse Company Dealers Hold Convention at Buffalo

About 150 electrical dealers of western New York and Pennsylvania attended the convention held by the Westinghouse Electric & Manufacturing Company, Buffalo office, co-operating with McCarthy Brothers & Ford, wholesale distributors of Buffalo, at the Statler Hotel in that city on Wednesday, April 23. J. H. Burns, general manager McCarthy Brothers & Ford, was chairman of the business sessions.

Westinghouse Company Bookings Show Increase

The Westinghouse Electric & Manufacturing Company in preliminary figures for the quarter ended March 31 shows bookings of $37,755,000, as compared with $36,435,000 in the preceding quarter, but this is less than the bookings for the corresponding period last year, which were $45,760,000. Sales billed for the quarter ended March 31 totaled $43,660,000, against $39,200,000 in the final three months of 1923 and $38,900,000 in the corresponding period last year.

Bookings for the fiscal year ended March 31 will show an increase of about 7 per cent over the previous year. Also billings for the year will show an increase of about 24 per cent over last year and will be about $156,570,000.

Western Electric Business Grows

A volume of business well in excess of last year is shown in figures for the first three months of 1924, just made public by the Western Electric Company. Billings for the first three months of 1924 amounted to $68,246,000, exceeding by $16,480,000 the total for the corresponding period of 1923. Orders booked were $80,591,000, or $12,793,000 more than orders received in the first quarter of last year.

Copperclad Steel Company Changes Name

The Copperclad Steel Company, Rankin, Pa., announces a change in its name to the Copperweld Steel Company. "Copperweld," the name of the wire made by the company's molten welding process, so completely subordinated the name "Copperclad" that it was deemed advisable to change the company name. The change in name does not involve any change in the organization or its policies.

William M. Rettinger proposes to build a factory site at Nekoosa, Wis., for the manufacture of two types of electric washing machines on which he has conducted experiments for many years. The factory will be electrically equipped and will employ about twelve men at the start.

G. A. Richardson of the Bethlehem Steel Company and the Bethlehem Shipbuilding Corporation, Ltd., gave a talk on the new Bethlehem two-cycle Diesel-type oil engine at a meeting of the Philadelphia Section of the American Society of Mechanical Engineers held April 22. This talk marked the first public showing of a new four-reel film featuring many of the details of this new engine, which is designed not only for marine use but also for use in large land plants.

The Wilson Welder & Metals Company, 132 King Street, New York, announces that the demand for welding machines and welding wire having necessitated increased manufacturing facilities, its plant and general offices were moved on May 1 to the Wilson Building, Hoboken, N. J.

The Burke Electric Company, Erie, Pa., announces the establishment of a branch sales office at 310 South Michigan Avenue, Chicago, in charge of Miles E. Standish.

The Duro Pump and Manufacturing Company, 545 East Monument Avenue, Dayton, Ohio, manufacturer of electric well pumps, etc., has opened a branch office at Sixth and Cherry Streets, Chattanooga, Tenn., with W. H. Lee as district manager covering the States of Tennessee, Alabama and Georgia.

D. T. Davis is now manager of the credit department at the Atlanta office of the Western Electric Company, succeeding W. B. Wallace. Mr. Davis was transferred from the Omaha office of the company.

The Gibbs Electric Company, Utica, N. Y., under the direction of Raymond A. Gibbs, is continuing the business formerly conducted by the R. & G. Electrical Company, which has been dissolved. A. Edward Rothenberg of the R. & G. company is retiring from business.

Arthur L. Mullergren, consulting engineer, Kansas City, Mo., announces that contracts have been let for the Fredonia (Kan.) electric light and distribution system, as follows: The power-plant building and oil-storage tank has been let to the F. C. Randel Construction Company, Wichita, Kan., for $19,780; the Diesel oil-engine generating units, switchboard and installation to the Worthington Pump & Machinery Company, Kansas City, Mo., for $61,375 and the distribution and street-lighting system to the Neben Brothers Electrical Construction Company, Muskogee, Okla., for $31,483.

The W. N. Matthews Corporation, St. Louis, has moved into its own building at Forest Park Boulevard and Spring Avenue, where the manufacture of both its electrical and paint-spraying equipment will be carried on. The building was formerly under lease to the Davis Boring Tool Company. This corrects an item appearing in the April 12 issue.

The Marion Electric Corporation, Marion, Ind. (formerly Allmur Manufacturing Company), is now manufacturing a new curling iron known as the "Red Streak."

Henry D. Sears, 80 Boylston Street, Boston, general sales agent for Weber wiring devices, announces the offering of a new specialty, known as "Can-delite," for converting an ordinary fixture to one of the candle type.

The Westinghouse Electric & Manufacturing Company recently held a conference of the illuminating engineers at the George Cutter works of that company at South Bend, Ind. The conference, which was the third annual meeting of this body of engineers, was held for the purpose of discussing problems related to the manufacture of lighting equipment. Officials of the George Cutter works and Westinghouse representatives from many district offices attended.

The Collyer Insulated Wire Company, Pawtucket, R. I., has awarded a contract for the building of a 60-ft. x 120-ft. one-story brick addition to the present building to cost approximately $30,000.

The Electric Storage Battery Company, 146 South Dearborn Street, Chicago, has completed plans and will soon commence work on a new plant at 4613 Southwestern Avenue. It will be 180 ft. x 335 ft. and cost in excess of $75,000.

The Detroit Electric Furnace Company, Detroit, announces the removal of its office to 2331 First National Bank Building.

The Line Material Company, South Milwaukee, Wis., is erecting a two-story addition and rebuilding its present plant. The new building will be a modern daylight type of structure, increasing the factory space to practically 100,000 sq.ft. and doubling the present production capacity of the plant. It is expected that building operations will be completed by July 1, 1924.

The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., announces that the General Electric Company has placed an order for Bethlehem-Dahl oil pumping and heating equipment for its new power house now being built in West Philadelphia.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Welding Transformer

An air-cooled welding transformer, with the secondary coil constructed of ¾-in x ⅛-in. soft-drawn copper strip and terminals of the same material brazed to the strip at the end of each turn, has been developed by the American Transformer Company, 178 Emmet Street, Newark, N. J. This arrangment obviates the clamp joints and cast copper formerly used, so that the rating has been increased from 400 amp. to 750 amp. The nuisance of joints becoming loose and the high loss inherent in the clamp joint has also been eliminated.

The transformer is wound with a two-coil primary so arranged that it can be connected in series for 220 volts or in parallel for 110 volts. It is rated at 1 kva., 60 cycles, 110/220 volts primary, 0.67-3.35 volts secondary (in five steps).

Trailer for Cable Reels

A trailer for use in conjunction with an electric tractor to handle cable reels of any size and of any weight up to 5 tons with one man, and known as the Mercury "Lif-trans" trailer, has been developed by the Mercury Manufacturing Company, 4118 South Halstead Street, Chicago. The trailer consists of a structural steel frame heavily braced and reinforced, providing an opening into which a reel fits; a lifting device for raising and holding the reel in position, and sturdy wheels on which the trailer and its load can be pulled by the tractor.

The motive power for lifting the reel is supplied by a heavy-duty motor drawing its power from the batteries of the tractor. When the trailer has been backed to bring the reel within the trailer frame, a shaft is placed through the center of the reel extending over curved prongs, or fingers, attached to the lifting member on each side of the trailer. These lifting members are then raised by vertical screws, worm-driven from a horizontal shaft connected to the motor by a silent chain and sprocket wheel. The entire control of the reel-lifting mechanism is so arranged that it can be handled by the tractor operator from his seat. Safety features, such as being able to lift the reel only to a predetermined height, automatically operated brakes to prevent any coasting effect, etc., are also incorporated.

Transformer Temperature Indicator

The Baker transformer temperature signal developed by C. W. Baker of the Packard Electric Company, Ltd., St. Catharines, Ontario, is being manufactured in this country by W. D. Crumpton & Company, 8 Bridge Street, New York, who are also sole distributors for all territory outside of Canada.

The signal is operated by a thermostat which moves a rod on which is mounted a drum, thus indicating at all times the operating temperature. A lower drum that engages with the upper or maximum-temperature drum always records the highest temperature attained by the transformer oil. The maximum-temperature drum is colored red and white, red denoting overload, white denoting safe load and white with black disk showing denoting underload. Temperature indications are in sufficiently large figures to be readily observed from the street level through a glass window in the head of the instrument. It is manufactured of non-rustable material throughout and is waterproof and weatherproof. It is made in three standard stem lengths, 7 in., 9 in. and 12 in., but any other stem length can be manufactured to order.

Ball-Bearing Pump.—A direct-gear-driven, ball-bearing, mounted, shallow-well pump, for wells having no greater than 22 ft. to 25 ft. suction lift, has been developed by the Ives Manufacturing Company, 203 Hanover Street, Baltimore. The pump is single-cylinder double-acting, brass-lined, and is made in several sizes. It is compactly designed and completely accessible and is operated by an eccentric drive working in oil at all times. Soft-rubber valves fitting on bronze-grid renewable seats permit noiseless operation even at high speed. The 120 gal.-per-hour unit is equipped with a ¼-hp. high-torque motor with automatic pressure control regulating from 20 lb. to 40 lb.

New Trade Literature

INSULATING FABRICS AND PAPERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a booklet, known as folder 4532-A, covering the "Westinghouse" fabrics and papers for insulating purposes.

INSULATORS CAPS AND SPLICING TOOLS.—The Memco Engineering Company, 381 Hamilton Street, Long Island City, N. Y., is distributing bulletins Nos. 110 and 401, describing the "Memco" adjustable insulator caps, types "M" and "HS," and the "Memco" seamless copper splicing sleeves and splicing tools respectively.

ELECTRIC FURNACES.—The General Electric Company has issued a new bulletin, No. 48721, entitled: "Direct-Heat Electric Furnaces in General Electric Factories," covering the annealing of castings and wire, heat treating, calorizing, sherardizing and other processes. The publication is mostly pictorial in content, illustrating the application of this type of heat to various operations in plants of that company. Details as to heat, dimensions and function of each installation shown are given in descriptive captions.

CEDAR POLES AND BUTT TREATING.—The Page & Hill Company, Minneapolis, has prepared a publication in handbook form entitled "Practical Information About Cedar Poles and Butt Treating." This book covers practical information on the storage and painting of poles, the proper and improper methods of loading cars, counting and tallying, and other data for use of engineers, purchasing agents, yard superintendents and foremen of line crews. The book also covers complete specifications for Northern white and Western red cedar poles.

HISTORY OF PETROLEUM.—The Tide Water Oil Sales Corporation, 11 Broadway, New York City, is distributing a booklet entitled "An Unusual History of Petroleum" which contains new and startling information about this product, and also gives some facts regarding the production and distribution of oils and greases for lubricating purposes.

ELECTRICAL INSTRUMENTS.—The Weston Electrical Instrument Company, Newark, N. J., has issued a general catalog covering the "Weston" electrical instruments. The catalog also contains four pages of charts which, if carefully studied, will be a valuable aid in selecting instruments.

DATA BOOK.—The Superior Switchboard & Devices Company, Canton, Ohio, has issued a booklet, entitled "Meterology," which has been compiled for the aid and convenience of metermen and contains practical data and diagrams on meter and switchboard installations.

Foreign Trade Notes

ELECTRIC PUMPING BEING ENCOURAGED AT TAKAO, JAPAN.—The use of electric pumps for irrigation purposes is being encouraged by the Takao (Taiwan) provincial government, according to Consul Harvey T. Goodier, Taihoku, Taiwan. A 2-hp. electric pump has been purchased by the agricultural association of Takao Province, which is being installed for experimental and demonstration purposes. Firms interested in this line of equipment are requested by the consulate to send literature or get in touch with Kangyo Ka, Takaoshu Takao, Taiwan, Japan.

ELECTRIFICATION OF ITALIAN RAILROADS AUTHORIZED.—The State Railroad Administration of Italy by a decree of December 31, 1923, *Commerce Reports* states, is authorized to grant private companies permission to equip the Voghera-Milano-Chiasso and the Verona-Brennero lines for electrical operation. The grant includes the supply of electricity as well as the maintenance and operation of electric plants for a period not to exceed thirty years. Article 2 of the decree states that the Railroad Administration must obtain the approval of the Minister of Public Works and of Finance in the matter.

CITY OF MILAN (ITALY) TO COMPLETE TELEPHONE INSTALLATION.—Arrangements have been made by the city of Milan, Italy, for a loan of 5,000,000 lire to the Italian Ministry of Posts and Telegraphs, according to *Commerce Reports*, to complete the work already commenced of installing 14,000 automatic telephones in two important districts of the city. Concessions for this work had been granted by the ministry to private interests which were unable to complete the installations because the ministry could not make partial payments as the work progressed. All revenue obtained from the telephones in question will be turned over to the city of Milan until the loan has been paid. The arrangement as planned is not incompatible with the general scheme now under consideration by the Italian government to release all government-owned telephone systems to private enterprise.

EXTENSION OF RAILWAY ELECTRIFICATION IN BRAZIL.—Approval has been given by the President of Brazil, according to *Commerce Reports*, to the plans for the electrification of the Paulista Railway between Campinas and Tatu. This is an extension of the railway already electrified by an American company from São Paulo to Campinas. The decree also grants free customs entry to materials imported for the proposed electrification.

IMPROVEMENTS CONTEMPLATED BY NEWFOUDLAND LIGHT & POWER COMPANY.—Electrical machinery and equipment will be required by the Newfoundland Light & Power Company, Ltd., St. Johns, Newfoundland, in connection with proposed extensions to its Petty Harbor plant now being planned. Intensive use of electricity for heating and household purposes is contemplated which should lead to a demand for electrical house-appliances of all kinds.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AMHERST, MASS.—The Amherst Gas Company contemplates some short electric line extensions during this year. J. J. O'Connell is manager.

BOSTON, MASS.—The Edison Electric Illuminating Company plans for the early erection of a five-story substation, 70 ft. x 80 ft., to be known as Substation 72, estimated to cost $165,000.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Company contemplates the installation of an 8,000-kw. turbine this year.

HINGHAM, MASS.—The Municipal Light Board contemplates rebuilding the transmission line to Weymouth at a cost of $5,500; extension to line on Cushing Street, $1,500, and extension to line on Hull Street, $1,800. Fred A. Atkins is manager.

HOLYOKE, MASS.—Bids will be received until May 9 by John J. Kirkpatrick, manager of the gas and electric department, for furnishing labor and material for alterations to building and foundations and settings for machinery at the electric station.

PRINCETON, MASS.—The managers of the municipal electric light plant contemplate extending the lines 2 miles. F. W. Bryant is manager.

WAKEFIELD, MASS.—The Electric Light Commission contemplates extension to the street-lighting system. S. H. Brooks is manager.

WOONSOCKET, R. I.—The United Electric Railways Company has begun the construction of a one-story substation, 60 ft. x 80 ft., at Front and Logee Streets, to be used primarily for transformer service.

Middle Atlantic States

BUFFALO, N. Y.—The Department of Public Works is considering the installation of luminous-arc lamps on Goodall Street.

COHOES, N. Y.—The Cohoes Power & Light Corporation plans to install an additional 12,500-kva. waterwheel generator, which it expects to have in operation in September. C. A. Davis is associate general manager.

CREEDMOOR, BOROUGH OF QUEENS, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until May 7 for construction work, including pump house for sewage-disposal plant, tunnel extension for underground heating system, etc.; sewage-disposal plant, heating and electric work, underground service connections, etc., at the Creedmoor Division of the Brooklyn State Hospital, Creedmoor.

LACKAWANNA, N. Y.—The Council plans to install an ornamental lighting system on the Ridge Road. It is proposed to install an underground system on the highway for existing overhead power lines.

NEW YORK, N. Y.—The Associated Gas & Electric Company has secured a controlling interest in the Staten Island Edison Company. A bond issue of $4,500,000 is being arranged to be used in connection with the acquisition and for proposed extensions and improvements.

NEW YORK, N. Y.—The New York Edison Company has acquired property at 168 West Sixty-fourth Street, adjoining present holdings at 170-174 West Sixty-fourth Street, and is reported to be considering the erection of a substation on the site.

NYACK, N. Y.—The Rockland Light & Power Company contemplates erecting an interconnecting transmission line to connect with the system of the Orange & Rockland Electric Company at Monroe. Charles Whetstone is assistant treasurer.

PAWLING, N. Y.—Application has been made to the Public Service Commission by the Harlem Valley Electric Corporation of Pawling for authority to construct and operate an electric lighting system in the town of Beekman.

ROME, N. Y.—The Northern New York Utilities, Inc., has been granted permission to take over and consolidate the Rome Gas, Electric Light & Power Company. A transmission line will be constructed from Rome to the Oneida-Lewis County line for connection with the system of the purchasing company.

SYRACUSE, N. Y.—The Syracuse Lighting Company has preliminary plans for the construction of a hydro-electric generating plant on the Salmon River, about 40 miles from the city, estimated to cost in excess of $600,000. A transmission line will be constructed to the city limits and substation erected. The last noted structure will cost approximately $350,000, with equipment.

CAMDEN, N. J.—The Victor Talking Machine Company plans for the installation of electric power equipment in its proposed ten-story plant addition, 70 ft. x 150 ft., estimated to cost $1,000,000.

PATERSON, N. J.—The installation of thirty-two 600-cp. commercial arc lamps in Broadway, between Main and Straight Streets, has been authorized by the Board of Public Works.

BIRDSBORO, PA.—The plant and system of the Birdsboro Electric Company have been purchased by new interests, which plan for extensions and improvements, including additional equipment.

CHAMBERSBURG, PA.—The Letterkenny-Franklin Township Power Company is being organized to erect and operate a transmission line for commercial service in Letterkenny Township. James Collin Jones, Bullitt Building, Philadelphia, is representative.

CHARLEROI, PA.—Steps have been taken by the Borough Council for the installation of an ornamental lighting system in the business section.

DANVILLE, PA.—Steps are being taken for the installation of a street-lighting system on the Bloomsburg Road, Mahoning Township, covering about 2 miles.

HAZLETON, PA.—The Pennsylvania Power & Light Company has acquired the former local plant of the Worthington Pump & Machinery Company and will remodel and equip it for central repair and distributing works.

POTTSVILLE, PA.—The East Penn Electric Company will arrange its local steam-operated electric power plant for emergency service, discontinuing continuous operation as soon as its new generating plant, now nearing completion, is placed in service. The last-noted plant represents an investment of $2,500,000.

READING, PA.—The Reading Hardware Company has filed plans for the erection of a three-story power house addition, estimated to cost $85,000, with equipment.

READING, PA.—The Metropolitan Edison Company has applied for permission to purchase and merge the Derry-Dauphin, Metropolitan-Royalton, Metropolitan-Middletown Electric and four other transmission companies in this section. Extensions will be made to transmission lines.

HUNTINGTON, W. VA.—Bids will be received by the United States Engineer until May 28, for the construction of a

power house at Dam 32, Ohio River, as per plans and specifications on file.

ROANOKE RAPIDS, VA.—The Virginia Railway & Power Company has plans under advisement for extensions and improvements in the power plant and system of the Roanoke Rapids Light & Power Company, estimated to cost in excess of $35,000. The property was recently acquired.

WASHINGTON, D. C.—Bids will be received by the United States Veterans' Bureau, Arlington Building, until May 22 for vacuum electrodes, high-frequency machines, lamps, etc., for laboratory service. (Circular VR-88.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer United States Army until May 19 for 150 amplifiers and 100 radio receivers. Circular C. P. 16827-2.)

North Central States

BATTLE CREEK, MICH. — The City Council is planning for the installation of an improved fire-alarm system to cost about $10,000. E. W. Arnold, 488 East Main Street, is architect.

ROCKFORD, MICH.—The Rogue River Electric Light & Power Company contemplates the installation of new waterwheels and a generating unit during the year. Otto Krause is chief electrician.

BELLEFONTAINE, OHIO. — Plans are under consideration for the purchase of a 700-kw. turbine for the municipal electric plant, to cost about $28,000.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of the Board of Education, Denton Building, until May 12 for furnishing labor and materials for installing wiring, conduit and fixtures in the Mary Dill School, located at Seventy-fourth Street, west of Fair Park Avenue. C. W. Handman is business manager.

CLEVELAND, OHIO.—Plans have been prepared by the Cleveland Electric Illuminating Company for a substation to be ereted on Euclid Avenue, East Cleveland, to cost about $60,000. E. J. Cook is engineer of construction.

MARIETTA, OHIO.—An agreement has been reached whereby the Washington County Fair Grounds will be leased to the civic welfare committee of the Marietta Lodge of Elks for a period of five years. Among the improvements contemplated to the grounds is the installation of an electric lighting system.

MILLERSBURG, OHIO.—The Ohio service Company has authorized the erection of a 33,000-volt transmission line from Sugar Creek.

MOWRYSTOWN, OHIO. — The Wise Electric Company is installing a 150-kva., three-phase, 60-cycle, 2,300-volt generator and a Hamilton Corliss engine. John A. Wise is owner and manager.

TOLEDO, OHIO. — The Toledo Edison Company is perfecting plans for enlarging its steam generating plant, known as the Acme station, to increase the capacity to 125,000 kw., to cost about $1,000,000. An extension to the belt transmission line encircling the city, to cost about $500,000, is under consideration.

BOWLING GREEN, KY.—Improvements contemplated by the Kentucky-Tennessee Light & Power Company include increasing the output of five hydro-electric plants by 10,000 kw., the construction of new substations, the erection of a 65-mile, 33,000/66,000-volt, three-phase, 60-cycle transmission line from Bowling Green to Hopkinsville, a 28-mile line to Brownsville and Kyrock, 33,000 volts, three-phase, 60 cycles. The total cost is estimated at about $475,000. O. E. Wessel is assistant general manager.

GUTHRIE, KY.—The Kentucky-Tennessee Light & Power Company contemplates rebuilding the entire distribution systems in Adams, Allenville and Guthrie, and also the transmission line. O. E. Wessel, Bowling Green, is assistant general manager.

HOPKINSVILLE, KY.—The Kentucky-Tennessee Light & Power Company contemplates rebuilding the entire distribution system and installing a new power circuit for the entire town, to cost about $30,000, and building a new substation, to cost about $20,000. O. E. Wessel, Bowling Green, is assistant general manager.

IRVINE, KY.—The Kentucky-Tennessee Light & Power Company contemplates the installation of a 500-kw. turbine with condenser, erecting 6 miles of 2,200-volt lines and 14 miles of 33,000-volt lines. O. E. Wessel, Bowling Green, is assistant general manager.

ANGOLA, IND. — The Indiana Electric Utilities Company, it is reported, has secured permission to purchase the system of the Indiana Utilities Company and the Economy Electric Company; also, to issue securities to the amount of $347,000 to finance same.

ROCKFORD, ILL.—The Rockford Electric Company plans to install a 15,000-kw. steam turbine this year. Adam Gschwindt is general manager.

URBANA, ILL.—Bids will be received until May 16 at the office of J. M. White, supervising architect, 256 Administration Building, University of Illinois, for general work, heating, plumbing and electric wiring of dairy manufactures building; heating, ventilating, plumbing and electric wiring of library; heating and ventilating of commerce building, and plumbing and electric wiring of men's gymnasium.

ASHLAND, WIS. — The Lake Superior District Power Company contemplates extensions and improvements to its electric generating plant, transmission, interurban and street railway and gas systems, to cost about $1,965,000.

BERLIN, WIS.—The installation of new stokers, furnaces, etc., to cost about $4,000, is under consideration by the Wisconsin Power, Light & Heat Company.

CHIPPEWA FALLS, WIS.—At an election held recently the proposal to purchase the local system of the Wisconsin-Minnesota Light & Power Company to be operated by the municipality was defeated.

GILLETT, WIS.—The Wisconsin Public Service Corporation, Green Bay, has acquired the system of the Gillett Public Service Company. The Wisconsin corporation plans to erect a transmission line 14 miles long from Stiles via Oconto Falls to Gillett, connecting this place with its High Falls hydro-electric plant and other steam stations. The proposed line will cost about $50,000.

MADISON, WIS.—Plans are being prepared by the Wisconsin Power, Light & Heat Company for the erection of a 12-mile extension to its transmission line at Markesan to improve the service at Dalton and Manchester, to cost about $22,460. The company also plans to erect a transmission line from Markesan to Marquette, to cost about $11,000, including the electric distribution system at Marquette.

MONROE, WIS.—The Wisconsin Utilities Company plans to change the conductors on its high-tension transmission line from Martintown to Monroe, and make other improvements, at a cost of about $14,500.

OWEN, WIS.—The Midland Public Service Company contemplates the rehabilitation of the distribution systems in Dorchester, Abbottsford and Spencer and rebuilding four substations this year. G. V. Rork is district manager.

WAUTOMA, WIS.—To meet the increased demands for electric service on its Red Grantie-Wautoma transmission line the Wisconsin Power, Light & Heat Company proposes to increase the voltage of this line, at a cost of about $13,500. The company also plans to extend its line to furnish service in Waukau, to cost about $7,000.

COURTLAND, MINN. — The Courtland Electric Company contemplates the erection of about 10 miles of urban transmission and distribution lines this year. H. E. Stellmacher is secretary and manager.

DETROIT, MINN.—Bids, it is reported, will soon be asked for extensions to the municipal electric plant, including an addition to power station, and for two 250-hp. water-tube boilers, to cost about $60,000. L. P. Wolff, Guardian Life Building, St. Paul, is engineer.

FERGUS FALLS, MINN.—At an election held recently the proposal to issue $650,000 in bonds for a municipal power plant was defeated.

LUVERNE, MINN.—The installation of a 400-kw. generating unit in the municipal electric plant this year is under consideration. George DeLate is manager.

MADISON, MINN.—The Electric Light Department contemplates local extension of primary lines in certain sections of the city. John O. Strand is superintendent.

MAYNARD, MINN. — The Municipal Electric and Power Department contemplates erecting some rural lines and improving the street-lighting system this year. L. A. Sanner is superintendent of the municipal electric plant.

TRACY, MINN. — The Citizens' Light, Heat & Power Company plans to rebuild its power station during 1924 and to install an additional generating unit in 1925. Emil W. Erick is president.

BONDURANT, IOWA.—The Bondurant Electric Company may possibly erect a few miles of farm lines, during 1924. J. M. Ingle is secretary and treasurer.

CLINTON, IOWA.—The Clinton Gas & Electric Company contemplates general extensions to its gas and electric service during the year. Thomas Crawford is manager.

DAVENPORT, IOWA. — The Hawkeye Electric Power Company contemplates the erection of about 40 miles of 4,400-volt single-phase transmission line this year. J. T. Manon is president and manager.

FORT SCOTT, KAN.—The Kansas Utilities Company is considering the installation of a new 2,000-kw. turbo-generator. Frank M. Stone is president and manager.

MULVANE, KAN.—The purchase of a Diesel-engine-driven generating unit for the municipal electric plant or connecting with the high-tension line of the Kansas Gas & Electric Company, Wichita, within the next three or four months is under consideration by the city officials. F. E. Shaw is superintendent.

ONAGA, KAN.—The installation of a new 80-hp. oil engine is contemplated by the Onaga Light, Heat & Power Company. W. H. Hiskey is manager.

SALINA, KAN. — The Salina Light, Power & Gas Company contemplates installing an additional lighting feeder. L. K. Del Homme is superintendent.

Southern States

CHARLESTON, S. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 7 for an electrc traveling bridge crane for the local navy yard. (Spec. 4,962.)

COCOA, FLA.—Extensions and improvements contemplated by the Brevard County Power Company this year include the installation of a 750-hp. Diesel oil engine with generator and the construction of three 22,000-volt substations, two of 400 kva. capacity and one of 100 kva., and the erection of 22 miles of 22,000-volt transmission line. J. B. Whitworth is general manager.

CLARKSVILLE, TENN.—The Kentucky-Tennessee Light & Power Company contemplates rebuilding the entire local distribution system. O. E. Wessel, Bowling Green, is assistant general manager.

NASHVILLE, TENN. — The Nashville Railway & Light Company contemplates extensions and improvements to its system, including the erection of new light and power lines, substation, relaying 12½ miles of track, power-plant equipment, etc.

CRICHTON, ALA.—The Mobile Paper Mills, Inc., Mobile, recently organized, contemplates the construction of a power house at its proposed local paper mill.

PONTOTOC, MISS.—The Municipal Electric Department contemplates overhauling the distribution system and changing it to 110/220 volts, three-wire, secondary with grounded neutral. L. E. Price is superintendent.

LAFAYETTE, LA.—Plans are under way to rebuild the municipal electric light plant and waterworks, for which $200,000 has been voted. The work will consist of rebuilding power station, the installation of three 600-hp. Diesel-engine-driven generating units, one switchboard and one deep-well pump. H. R. Bodemuller is consulting engineer.

ABILENE, TEX. — Arrangements have been made by the West Texas Utilities Company to interconnect its system with the lines of the Wichita Falls (Tex.) Electric Company, Oil Belt Power Company and the Texas Power & Light Company for exchange of power. The cost is estimated at $300,000.

BYNUM, TEXAS.—The Bynum Power & Light Company, recently organized, contemplates the construction of a transmission line. J. M. White is head.

HOUSTON, TEX.—The Houston Lighting & Power Company has contracted to furnish power to the proposed local cotton mill to be erected by William A. Mitchell and associates at a cost of about $500,000. A transformer station will be installed at the plant.

LUBBOCK, TEX.—Bids, it is understood, will be asked by the Texas Technical College, care A. G. Carter, chairman Board of Regents, Star-Telegraph Building, Fort Worth, within sixty days for construction of administration and chemical buildings,

power house and president's residence. The cost of the first unit is estimated at $500,000. Robert & Company, Interurban Building, Dallas, are engineers.

MINEOLA, TEX.—The East Texas Public Service Company has acquired the local plant and property of the Mineola Light, Ice & Power Company. The new owner plans for extensions in transmission lines, as well as additional equipment in the local power plant.

SAN ANTONIO, TEX.—The San Antonio Public Service Company, it is reported, has purchased a site on the Guadalupe River, below New Braunfels, on which it proposes to erect a steam-turbine power plant.

TAHOKA, TEX.—The City Council has authorized the installation of a street-lighting system in the downtown section and on other important streets.

Pacific and Mountain States

PORT ANGELES, WASH.—Permission has been granted to the Northwest Power & Manufacturing Company to begin work on its proposed 20,000-hp. hydro-electric power plant on the Elwah River in Clallam County. The cost of the plant is estimated at $1,600,000.

SEATTLE, WASH.—The American Can Company, 120 Broadway, New York, N. Y., plans for the installation of electric power equipment at its proposed plant addition at Clay and Elliott Avenues, estimated to cost $500,000.

AUBURN, CAL.—The Bear River Power Company has applied to the State Water Department for permission to construct and operate a hydro-electric power plant on the Bear River in Placer and Nevada Counties, to develop a capacity of 43,000 hp.

LOS ANGELES, CAL.—The Southern California Edison Company has been granted permission to issue preferred stock for $10,000,000, the majority of the fund to be used for extensions in generating plants and transmission lines.

RAMONA, CAL.—A lighting district is being organized which will be served by the San Diego Consolidated Gas & Electric Company. It is expected that the new transmission line will be erected within the next three or four months.

SAN DIEGO, CAL.—Bids will be received until May 14 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of barracks, quarters, sewer, gas, electric light and power and telephone connections, freight elevators, etc., at the local naval operating base.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been granted permission to use waters from Fordyce Creek for hydro-electric development, totaling 17,170 hp., estimated to cost $745,500. The site is in Nevada County; also for a similar development on the Bear River in Nevada and Placer Counties, for 8,700 hp. station capacity.

SAN FRANCISCO, CAL.—The construction of a substation at Junipero Sierra Boulevard and Ocean Avenue, to cost about $50,000, is under consideration by the Pacific Gas & Electric Company.

POST FALLS, IDAHO.—Edwin S. Crane and associates are planning for the construction of a hydro-electric power plant on the Spokane River. A company will be organized, it is stated, to carry out the project, estimated to cost $200,000.

MILES CITY, MONT.—A 750-kw. turbine may possibly be installed in the municipal electric plant this year. Carl A. Becraft is superintendent.

COLORADO SPRINGS, COL.—A special election will be held May 20 to submit to the voters the proposal to issue $1,250,000 in bonds to establish a municipal electric plant.

NEW RAYMER, COL.—The Raymer Light & Power Company, Boulder, is planning to build a new plant. The equipment is to include one 75-kva. and one 37½-kva. 2,300/1,150/115/230-volt generator, two fuel-oil engines, transformers, etc. An ice plant may be installed later on. C. L. Brockett is president and manager.

Canada

PORT MOODY, B. C.—The British Columbia Electric Railway Company contemplates the construction of a local substation to cost about $60,000.

TORONTO, ONT.—Plans are being prepared by he Ontario Hydro-Electric Power Commission for the erection of high-voltage substations at Guelph, Preston, Woodstock, Stratford and other points in Kent and Essex Counties, to cost about $500,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 8, 1924)

1,489,809. INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Sept. 5, 1919. Metal cap cemented to porcelain.

1,489,818. FRONT TRAFFIC SIGNAL FOR AUTOMOBILES; E. Cinquini, New Haven, Conn. App. filed July 3, 1922.

1,489,835. BINDING CLAMP FOR BRANCHING OFF; H. Kietz, Magdeburg, Germany. App. filed Nov. 4, 1919. For conductor tap.

1,489,842. INSULATION BLOCK AND ELECTRICAL CONNECTION FOR THE BURNERS OF ELECTRIC RANGES; R. H. MacInnes, Hamilton, Ontario, Canada. App. filed May 24, 1923.

1,489,843. SECTIONAL INSULATION BLOCK FOR SUPPORTING AND STRINGING; R. H. MacInnes, Hamilton, Ontario, Canada. App. filed May 24, 1923. For ovens of electric ranges.

1,489,848. MULTIPLE-DRIVE MOTOR; W. J. O'Leary, Montreal, Quebec, Canada. App. filed Aug. 6, 1918. For toy motors.

1,489,920. SAFETY DEVICE FOR PYROMETERS; R. P. Brown, Philadelphia, Pa. App. filed Feb. 20, 1922. Where operation beyond a predetermined limit may result in a condition of danger.

1,489,937. SEPARABLE ATTACHMENT PLUG; M. F. Fitzgerald, Winsted, Conn. App. filed March 4, 1920.

1,489,978. SOUND-RECEIVER EARPIECE; O. Byron, Jersey City, N. J. App. filed Aug. 3, 1922.

1,490,031. CIRCUIT ARRANGEMENT FOR GENERATING PURE CONTINUOUS CURRENTS; K. Schmidt, Berlin, Germany. App. filed July 26, 1920. For operation of microphones.

1,490,040, 1,490,041. ELECTRICAL COIL; M. W. Sterns, New York, N. Y. App. filed Feb. 10, 1919. Inductance coils, honeycomb type, as used in radio communication.

(Issued April 15, 1924)

15,817 (reissue). NON-GROUNDED OR METALLIC LINE-CIRCUIT SYSTEM; R. H. Burfeind, Chicago, Ill. App. filed April 18, 1907. For automatic or semi-automatic telephone-sxchange systems.

1,490,080. INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Sept. 5, 1919. Suspension type.

1,490,086. ELECTRIC LIGHT SUPPORT; L. C. Beadle, Crystal Valley, Mich. App. filed June 23, 1921. Adjustable.

1,490,087. MEANS FOR SOLDERING; J. Brenzinger, Fairfield, Conn. App. filed June 13, 1922. In an automatic or semi-automatic manner.

1,490,088, 1,490,089. AIR HEATER; L. B. Bridges, Brooklyn, N. Y. App. filed July 14, 1921. For use in connection with sanitary drying apparatus and appliances in which the drying is effected by means of a blast of heated air.

1,490,104. BRUSH HOLDER; C. F. Gilchrist, Toledo, Ohio. App. filed March 4, 1920. Box type.

1,490,105. LIGHTNING ARRESTER; J. T. Greene, Toledo, Ohio. App. filed April 9, 1910. Vacuum arrester of the cartridge type.

1,490,125. TOY MOTOR; W. J. O'Leary, Montreal, Canada. App. filed Aug. 6, 1918. Solenoid type.

1,490,127. LAWN MOWER; J. W. Peters, Roslyn, N. Y. App. filed April 9, 1921. Self-propelled with distant electric control.

1,490,137. CUPPING DEVICE; T. H. Springer, Waterloo, Iowa. App. filed Jan. 3, 1921. For simultaneous electric and vacuum treatments of organs of the body.

1,490,147, 1,490,148. CAR-COUPLING MECHANISM; W. V. Turner, Wilkinsburg, Pa. App. filed Dec. 18, 1918. Including means for making train-pipe connections.

1,490,155. ELECTROMAGNETIC POWER DEVICE; O. Zbinden, Berne, Switzerland. App. filed Nov. 1, 1920. Reciprocating motion with one winding connected to a source of continuous current, the other to alternating current.

1,490,165. BALANCED ANTENNA SYSTEM; L. Espenschied, Hollis, N. Y. App. filed Sept. 30, 1919. For preventing interference between oppositely directed radio transmissions.

1,490,166. CARRIER TELEGRAPH CIRCUITS; L. Espenschied, Queens, N. Y. App. filed Oct. 21, 1920.

1,490,167. AMMETER; D. V. Fallon, Detroit, Mich. App. filed July 26, 1920. Utilizing a magnet with a movable armature.

1,490,171. MAGNETO; I. E. Hendrickson, Springfield, Mass. App. filed Sept. 30, 1921. Reciprocating armature type.

1,490,191. WELDING APPARATUS; C. T. Allcutt, Pittsburgh, Pa. App. filed June 25, 1921. Electro-percussive welding.

1,490,195. ELECTRICAL CONNECTOR DEVICE; R. D. Benjamin, Chicago, Ill. App. filed Aug. 11, 1917. Whereby receptacle devices of different types may be interchangeably secured to the same wiring base.

1,490,197. MOTOR-CONTROL SYSTEM; E. M. Bouton, Wilkinsburg, Pa. App. filed Aug. 17, 1920. For operating motors which must repeatedly reverse their direction of operation, such as reversing planer motors.

1,490,198. SYSTEM OF CONTROL; Q. A. Brackett, Pittsburgh, Pa. App. filed Jan. 24, 1921. For controlling the radiation of electrical energy in the form of electromagnetic waves.

1,490,202. BUSBAR SUPPORT; J. M. Brown, Pittsburgh, Pa. App. filed Nov. 28, 1919.

1,490,203. DEAD-END TERMINAL; J. M. Brown, Pittsburgh, Pa. App. filed April 7, 1920. For dead-ending and adjusting the slack in conductors.

1,490,204. SEPARATOR AND PROCESS OF TREATING THE SAME; R. N. Chamberlain, Chicago, Ill. App. filed March 2, 1921. For storage batteries.

1,490,205. DYNAMO-ELECTRIC MACHINE; B. H. Chatto, Swissvale, Pa. App. filed Jan. 14, 1918. Adapted for either wall, ceiling or floor mounting.

1,490,207. ELECTRIC FURNACE; O. A. Colby, Irwin, Pa. App. filed April 13, 1922. Electric resistance type.

1,490,209. ARC-WELDING DYNAMO-ELECTRIC MACHINE; K. L. Hansen, Wilkinsburg, Pa. App. filed Sept. 23, 1919. Constant-current type.

1,490,211. ELECTRICAL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed Oct. 18, 1919. For controlling the direction of operation and the speed of electric motors by varying the polarity and excitation of a separately exicted generator.

1,490,216. CONTROL SYSTEM; H. L. Keith, Wilkinsburg, Pa. App. filed May 23, 1919. For controlling compound-wound direct-current motors during the period immediately following their starting operation.

1,490,226. ELECTRIC HEATING SYSTEM FOR STEAM LOCOMOTIVES; D. Mottura, Chisholm, Minn. App. filed July 27, 1923.

1,490,228. CONTROL SYSTEM; F. M. Parks, Murrysville, Pa. App. filed Sept. 24, 1920. For hoists.

1,490,236. COMBINED CIGAR LIGHTER AND ADVERTISING DEVICE; J. L. Smith, Buffalo, N. Y. App. filed May 3, 1922.

1,490,241. ELECTRIC IRON; F. Thornton, Jr., and C. J. Fay, Mansfield, Ohio. App. filed April 12, 1921. With special support for contact terminals.

1,490,242. STREET-CAR HEATER; F. Thornton, Jr., Mansfield, Ohio. App. filed July 22, 1921. Metallic resistor type.

1,490,243. SECTIONAL BAKE OVEN; F. Thornton, Jr., Mansfield, Ohio. App. filed March 17, 1922. Unitary-structure multiple-chamber oven.

1,490,252. OUTLET BOX; C. H. Bissell, Syracuse, N. Y. App. filed Jan. 19, 1923.

1,490,272. AIM INDICATOR; H. M. Hickam, Washington, D. C. App. filed Feb. 2, 1923. Using an electric lamp and a lens on any firearm.

1,490,276. ELECTRIC DRILL OR HAMMER; A. D. Kenyon, Denver, Col. App. filed Jan. 14, 1922. Reciprocating armature.

1,490,277. ELECTROTYPE MOLD AND PROCESS OF PRODUCING THE SAME; J. Knittle, Minneapolis, Minn. App. filed April 15, 1922.

1,490,298. TERMINAL BOX; F. A. Tefft, Toledo, Ohio. App. filed July 5, 1921. May also be used for supporting a fixture.

1,490,299. TRANSFORMER INSULATION RING; A. W. Thompson, East McKeesport, Pa. App. filed Feb. 15, 1919.

1,490,306. METHOD OF AND MEANS FOR ATTACHING CONDUCTORS; O. E. Becker, Chicago, Ill. App. filed July 8, 1921. To studs, brushes, etc.

1,490,307. BRUSH FOR ELECCTRICAL APPARATUS AND METHOD OF MAKING SAME; O. E. Becker, Chicago, Ill. App. filed Nov. 7, 1921.

1,490,313. SIREN CONTROL SYSTEM; O. S. Burke, Chicago, Ill. App. filed April 10, 1922. For manually controlled fire-alarm systems.

1,490,319. STORAGE-BATTERY PLATE; A. O. Garrett, San Diego, and C. E. Funnell and W. I. Hoffman, Los Angeles, Cal. App. filed Dec. 17, 1920.

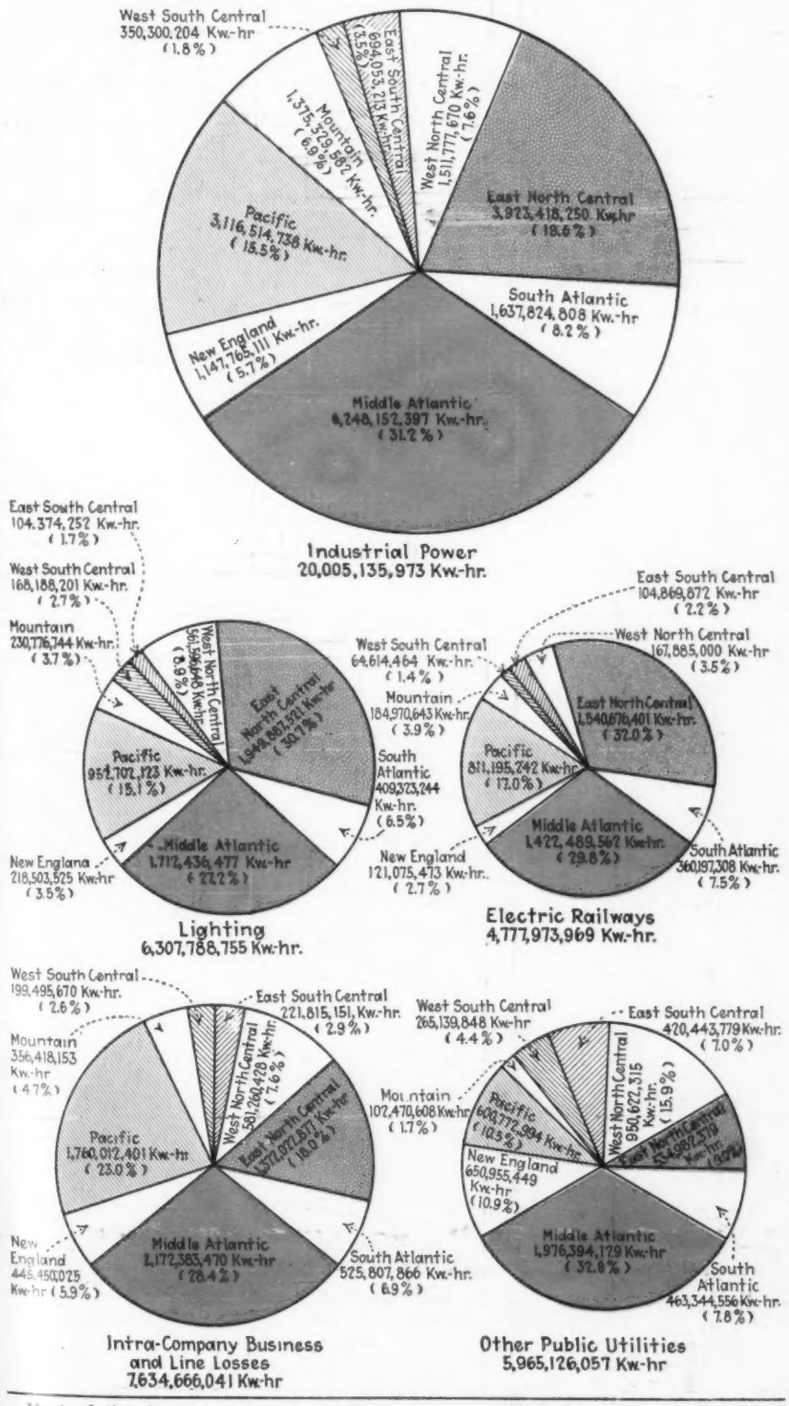
1,490,332. DIAPHRAGM FOR ELECTROLYTIC CELLS; I. H. Levin, New York, N. Y. App. filed Oct. 4, 1921.

1,490,334. RHEOSTAT; J. F. Lindberg, Chicago, Ill. App. filed May 29, 1922. With contact arm sliding longitudinally on continuous wires.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

How the Output of the 105 Largest Central-Station Companies Was Distributed in 1923


West South Central 350,300,204 Kw.-hr (1.8%)
East South Central 694,053,213 Kw.-hr (3.5%)
West North Central 1,511,777,670 Kw.-hr (7.6%)
East North Central 3,923,418,250 Kw.-hr (18.6%)
South Atlantic 1,637,824,808 Kw.-hr (8.2%)
Middle Atlantic 6,248,152,397 Kw.-hr (31.2%)
New England 1,147,765,111 Kw.-hr (5.7%)
Pacific 3,116,514,738 Kw.-hr (15.5%)
Mountain 1,375,379,582 Kw.-hr (6.9%)
Industrial Power 20,005,135,973 Kw.-hr.
East South Central 104,374,252 Kw.-hr (1.7%)
West South Central 168,188,201 Kw.-hr (2.7%)
Mountain 230,776,744 Kw.-hr (3.7%)
West North Central 561,566,648 Kw.-hr (8.9%)
East North Central 1,948,867,321 Kw.-hr (30.7%)
Pacific 952,702,123 Kw.-hr (15.1%)
South Atlantic 409,373,244 Kw.-hr (6.5%)
Middle Atlantic 1,712,436,477 Kw.-hr (27.2%)
New England 218,503,525 Kw.-hr (3.5%)
Lighting 6,307,788,755 Kw.-hr.
East South Central 104,869,872 Kw.-hr (2.2%)
West North Central 167,885,000 Kw.-hr (3.5%)
West South Central 64,614,464 Kw.-hr (1.4%)
Mountain 184,970,643 Kw.-hr (3.9%)
East North Central 1,540,676,401 Kw.-hr (32.0%)
Pacific 811,195,242 Kw.-hr (17.0%)
Middle Atlantic 1,422,489,562 Kw.-hr (29.8%)
South Atlantic 360,197,308 Kw.-hr (7.5%)
New England 121,075,473 Kw.-hr (2.7%)
Electric Railways 4,777,973,969 Kw.-hr.
West South Central 199,495,670 Kw.-hr (2.6%)
East South Central 221,815,151 Kw.-hr (2.9%)
Mountain 356,418,153 Kw.-hr (4.7%)
West North Central 581,280,428 Kw.-hr (7.6%)
East North Central 1,371,071,877 Kw.-hr (18.0%)
Pacific 1,760,012,401 Kw.-hr (23.0%)
Middle Atlantic 2,172,383,470 Kw.-hr (28.4%)
New England 445,450,025 Kw.-hr (5.9%)
South Atlantic 525,807,866 Kw.-hr (6.9%)
Intra-Company Business and Line Losses 7,634,666,041 Kw.-hr
West South Central 265,139,848 Kw.-hr (4.4%)
East South Central 420,443,779 Kw.-hr (7.0%)
Mountain 107,470,608 Kw.-hr (1.7%)
Pacific 600,772,994 Kw.-hr (10.1%)
West North Central 950,672,315 Kw.-hr (15.9%)
East North Central 554,987,379 Kw.-hr (9.3%)
New England 650,955,449 Kw.-hr (10.9%)
Middle Atlantic 1,976,394,179 Kw.-hr (32.8%)
South Atlantic 463,344,556 Kw.-hr (7.8%)
Other Public Utilities 5,965,126,057 Kw.-hr

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Environment and Central-Station Load

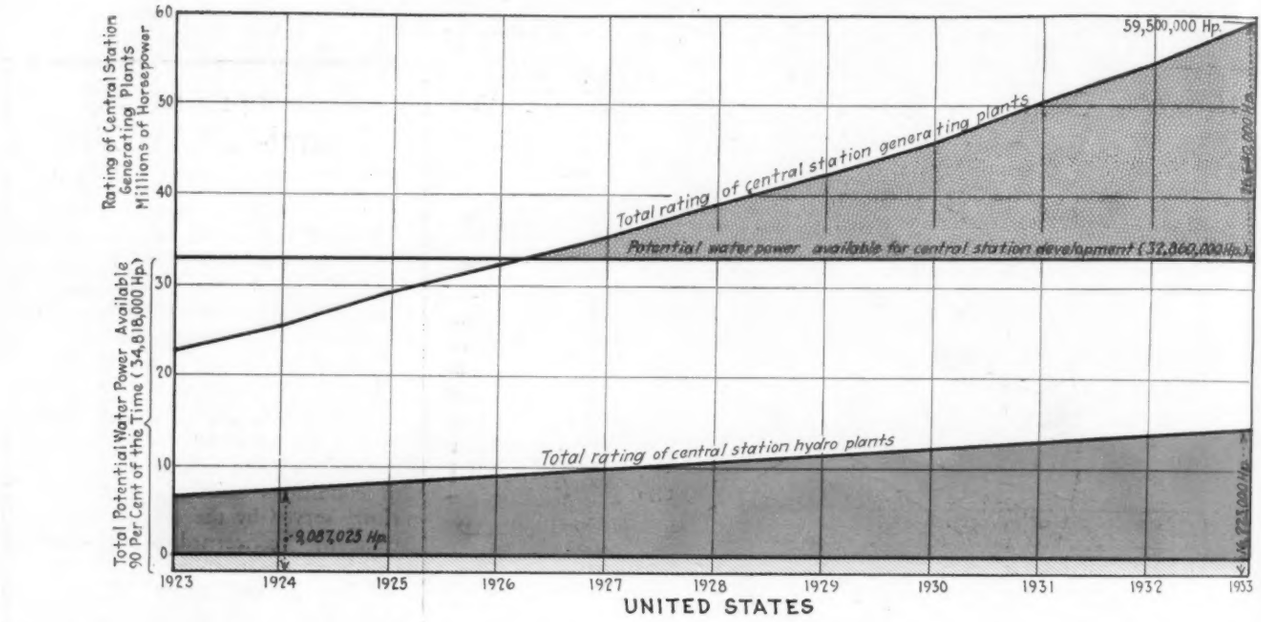
ENVIRONMENT not only plays a large part in human life, but also enters very largely into the ramifications of business and industrial life. But perhaps no primary industry is more influenced by environment than the electric light and power industry. The cost of operation, type of generating plant, gross income from sale of energy and the distribution of load are very largely the result of conditions existing in the territory served by the central-station company concerned — in other words, of environment.

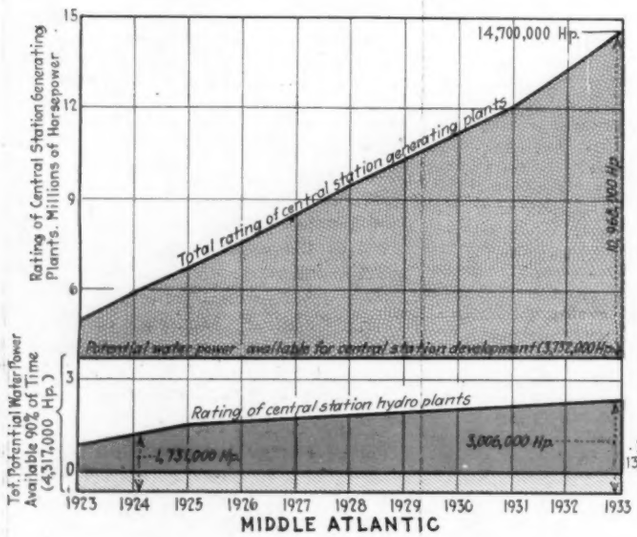
The accompanying diagrams show the distribution of the load of the 105 central-station companies of the United States having an output of more than one hundred million kilowatt-hours in 1923. The distribution as shown may be taken as indicative of the industry as a whole, since the output of these largest companies represents approximately 83 per cent of the total energy generated by the industry.

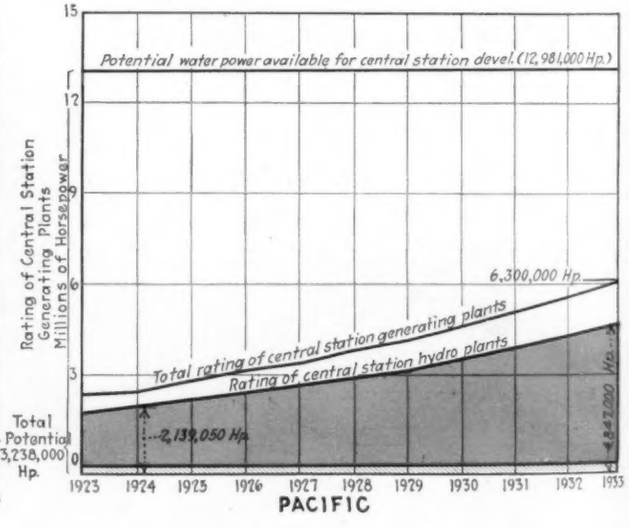
In the northeastern and east north central sections of the country are the great manufacturing and mining industries, and it is not surprising therefore that 56.5 per cent of the total consumption of energy for power purposes is credited to these combined sections. Similarly these sections boast of the largest cities and greatest density of population, and as a result more than 61 per cent of the lighting load was distributed by companies operating in these sections. These concentrated groups of people demand rapid and efficient short-distance transportation, which demand calls for large sales of energy by the central stations of these sections to electric railway companies. In the West are the large water powers high up in the mountains and far from the centers of distribution, and so here line losses play a large part in company operations.

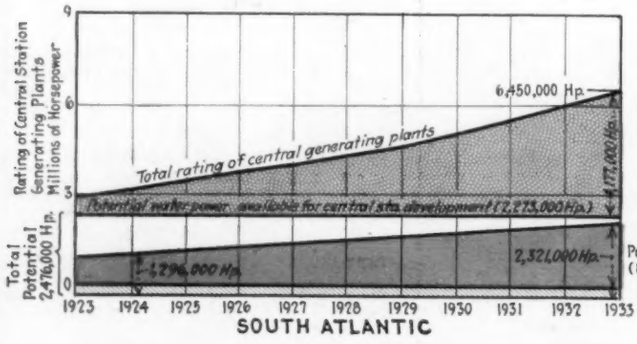
The operations of a central-station company are without question the result of environment.

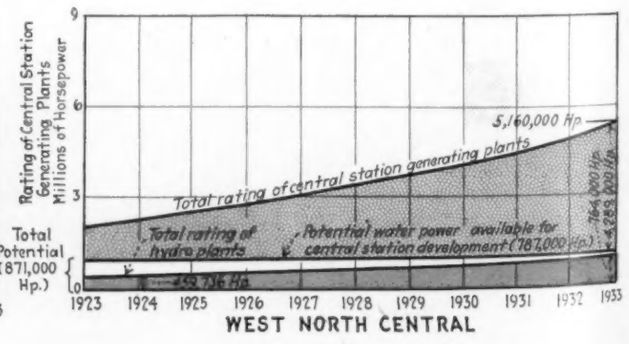
The Potential Water Powers Available 90 per cent of the Tim

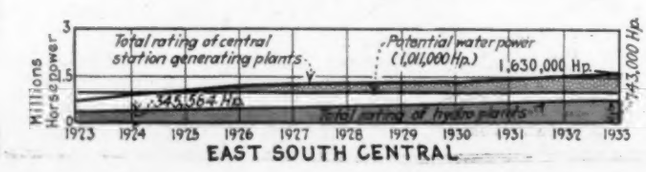

Rating of Central Station Generating Plants Millions of Horsepower
Total Potential Water Power Available 90 Per Cent of the Time (34,818,000 Hp.)
59,500,000 Hp.
Total rating of central station generating plants
Potential water power available for central station development (32,860,000 Hp.)
Total rating of central station hydro plants
9,087,025 Hp.
UNITED STATES

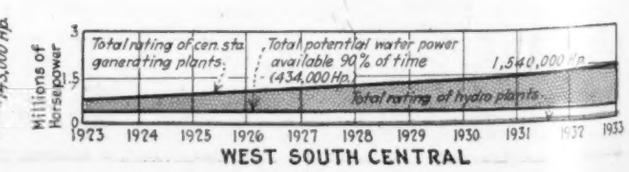

Rating of Central Station Generating Plants. Millions of Horsepower
Tot. Potential Water Power Available 90% of Time (4,317,000 Hp.)
14,700,000 Hp.
Total rating of central station generating plants
Potential water power available for central station development (3,737,000 Hp.)
Rating of central station hydro plants
4,731,000 Hp.
3,006,000 Hp.
MIDDLE ATLANTIC


Rating of Central Station Generating Plants Millions of Horsepower
Potential water power available for central station devel. (12,981,000 Hp.)
6,300,000 Hp.
Total rating of central station generating plants
Rating of central station hydro plants
Total Potential 13,238,000 Hp.
2,139,050 Hp.
PACIFIC

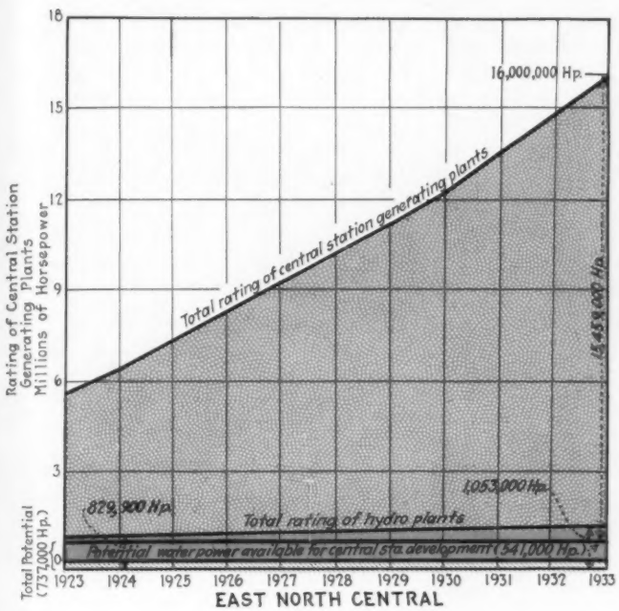

Rating of Central Station Generating Plants Millions of Horsepower
Total Potential 2,416,000 Hp.
6,450,000 Hp.
Total rating of central generating plants
Potential water power available for central sta. development (2,275,000 Hp.)
1,296,000 Hp.
2,321,000 Hp.
SOUTH ATLANTIC

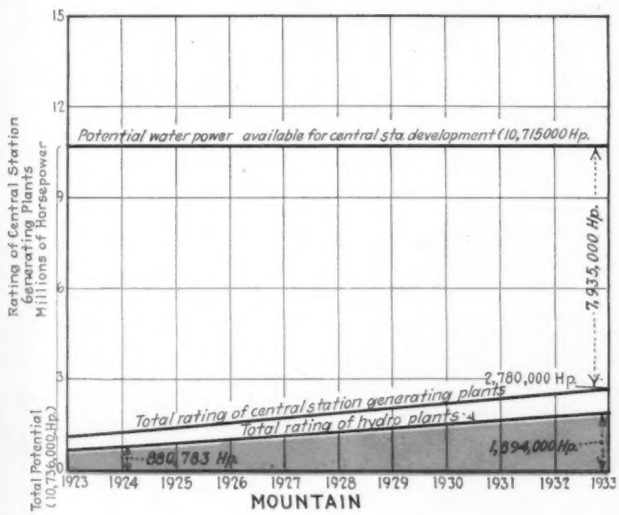

Rating of Central Station Generating Plants Millions of Horsepower
5,160,000 Hp.
Total rating of central station generating plants
Total rating of hydro plants
Potential water power available for central station development (787,000 Hp.)
Total Potential (871,000 Hp.)
WEST NORTH CENTRAL

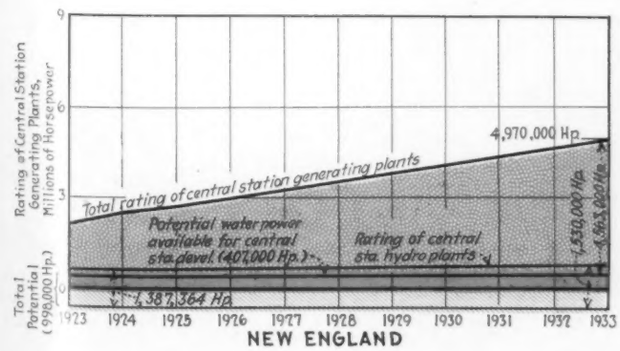



Millions of Horsepower
Total rating of cen. sta. generating plants
Total potential water power available 90% of time (434,000 Hp.)
1,540,000 Hp.
Total rating of hydro plants
WEST SOUTH CENTRAL

Time Will Not Supply the Needs of the Country After 1927


16,000,000 Hp.
Total rating of central station generating plants
Rating of Central Station Generating Plants Millions of Horsepower
15,453,000 Hp.
1,053,000 Hp.
829,900 Hp.
Total rating of hydro plants
Potential water power available for central sta. development (541,000 Hp.)
Total Potential (737,000 Hp.)
1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933
EAST NORTH CENTRAL


Potential water power available for central sta. development (10,715000 Hp.
Rating of Central Station Generating Plants Millions of Horsepower
7,935,000 Hp.
2,780,000 Hp.
Total rating of central station generating plants
Total rating of hydro plants
880,783 Hp.
4,894,000 Hp.
Total Potential (10,736,000 Hp.)
1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933
MOUNTAIN


4,970,000 Hp.
Total rating of central station generating plants
Rating of Central Station Generating Plants, Millions of Horsepower
Potential water power available for central sta. devel. (407,000 Hp.)
Rating of central sta. hydro plants
1,530,000 Hp.
1,387,364 Hp.
Total Potential (990,000 Hp.)
1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933
NEW ENGLAND

Present and probable future actual water power developments of central station companies

Estimated industrial water power developments. (Assume constant for the future)

Rating of electric generating plants in excess of total maximum potential water powers available for central station development

Available Water Power and Its Relation to Power Demands

MUCH has been written and spoken during the past few years concerning the national distribution of electric energy based on the use of the water powers of the country as a primary source of power. It has even been fantastically urged that if the water powers were all developed, either by sections or with national interconnection there would be no further need of steam-electric plants. That most of the conclusions reached by many who talked on this subject were reached without full data has long been recognized—as a matter of fact, full data have not been available.

During the past week, however, data have been made available which render possible an intelligent approach to the analysis of the question as to what extent, if at all, hydro-electric development may be expected to replace steam or whether it will merely assist in meeting future demands for growth of electric generating capacity.

The United States Geological Survey, after careful study of reports from its engineers and of a tabulation of existing developments, estimates that the potential water powers of the country available 90 per cent of the time total 34,818,000 h.p., of which 9,087,025 h.p. has been developed at the present time. Taking these basic figures, the ELECTRICAL WORLD has segregated the developed water powers into those developed by central-station companies and those developed by industrial companies, thereby arriving at the potential water powers of the country and of the various sections which are available for central-station development. Drawing upon a study of the future growth of the industry for the next ten years, the results of which were published in the January 5, 1924, issue of the ELECTRICAL WORLD, the accompanying charts have been plotted, assuming that the total industrial water-power developments will remain constant. It should be remembered that these figures are based on installed generator capacity.

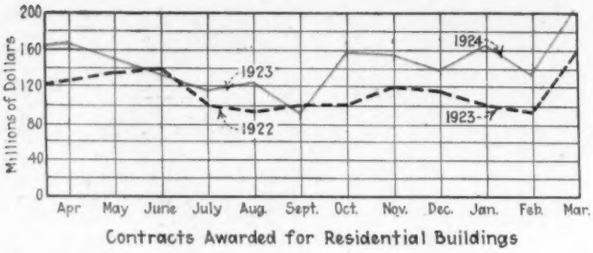
Looking first at the country as a whole and even assuming the impossible—that all potential water power could be developed by 1927 and tied into a national network—it appears that all the potential water power available 90 per cent of the time would not alone supply the needs of the central-station industry after 1927. In other words, with hydro-electricity used to the utmost theoretically possible, all future growth after 1927 would be steam growth, and it would be only a few years, about 1931, till the steam-plant rating would be equal to the present rating—and still growing. The potential water powers available for central-station development total 32,860 000 h.p., and the total rating of the central-stations of the country will pass this available power figure during the year 1926. By 1933 the rating of the central generating plants of the country will exceed the total maximum potential water powers available for central-station development by 26,640,000 h.p. Thus by 1933, if all the water powers of the country available 90 per cent of the time and available for central-station development were developed, there would remain fuel-burning generating plants with a rating approximately equal to the total maximum potential water powers of the country.

In the Middle Atlantic States, as a section, notwithstanding the tremendous water powers available at Niagara and on the St. Lawrence, it appears that if these were developed under treaty regulations, and if all the other maximum water powers in the section were also developed, the central-station rating of this section at present would still be over two million horsepower in excess of the hydro power available, and that by 1933 almost eleven million horsepower would be supplied by fuel-burning plants. The East North Central States, with only a relatively small amount of water power available for development, would account for over 15,000,000 h.p. of fuel-burning electric generating plants after all the available water powers has been developed. New England has already overdeveloped her maximum potential water powers and by 1933 will have probably 4,563,000 h.p. of fuel-burning plants, although this may be cut down by a development of a portion of the water powers available only 50 per cent of the time. The Pacific and Mountain sections are the only two in which the potential water powers will exceed the rating of central-station generating plants in 1933.

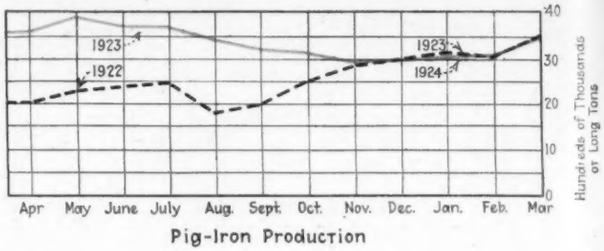
If the present rate of growth in water-power developments continues, the total development by 1930 should total slightly over sixteen million horsepower, or 46 per cent of the total potential water powers available 90 per cent of the time.

This analysis shows that with water-power development proceeding as rapidly as it can, the steam-electric station will still be the most important single factor in the supply of central-station service.

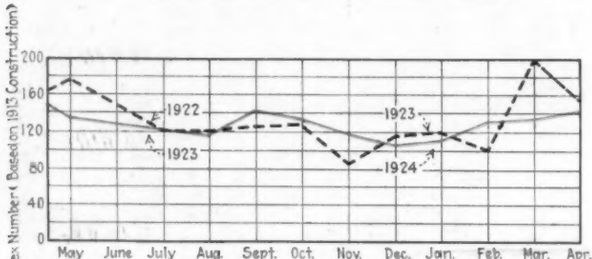
How the Primary Industries Are Trending



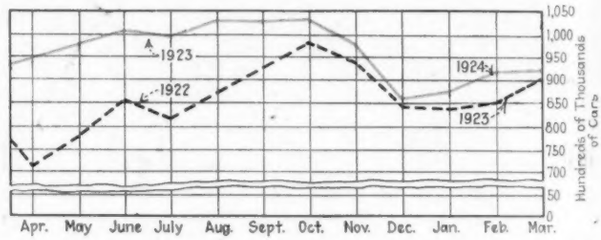
Contracts Awarded for Residential Buildings



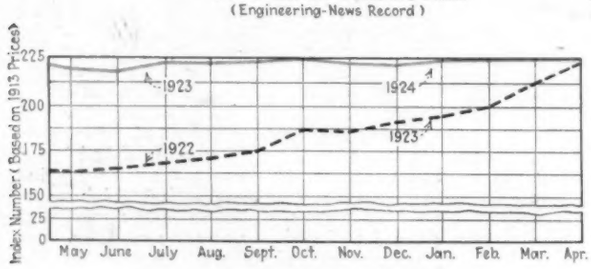
Pig-Iron Production



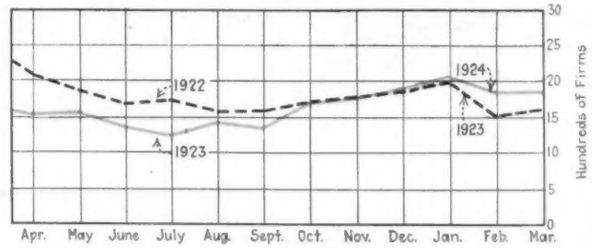
Construction Volumne Index
(Engineering-News Record)



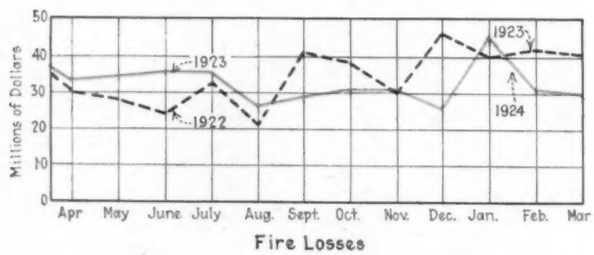
Total Average Weekly Freight-Car Loadings



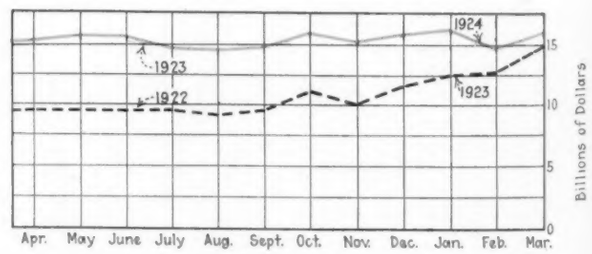
Construction Cost Index
(Engineering-News Record)



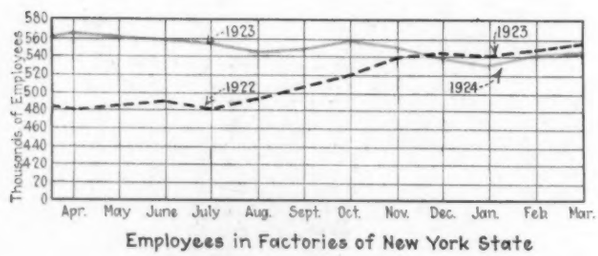
Business Failures



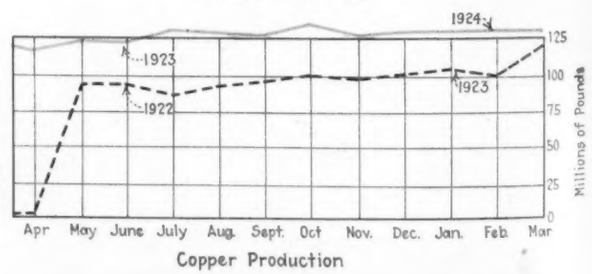
Fire Losses



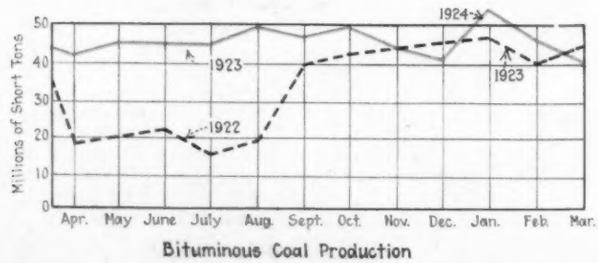
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

More Caution in General Business

MARCH witnessed no material change in the fundamental business conditions of the country, but an increasing note of caution has been very noticeable for the past six weeks. This tendency toward a more careful feeling out of the future may affect electrical manufacturing to a certain extent, but history has clearly proved the independence of the electric light and power industry of general business conditions. All statistics point to another record year for the central station.